Flight
13 SEPTEMBER 1957

ONE SHILLING & SIXPENCE

FLIGHT

OFFICIAL ORGAN OF THE ROYAL AERO CLUB

Farnborough Review

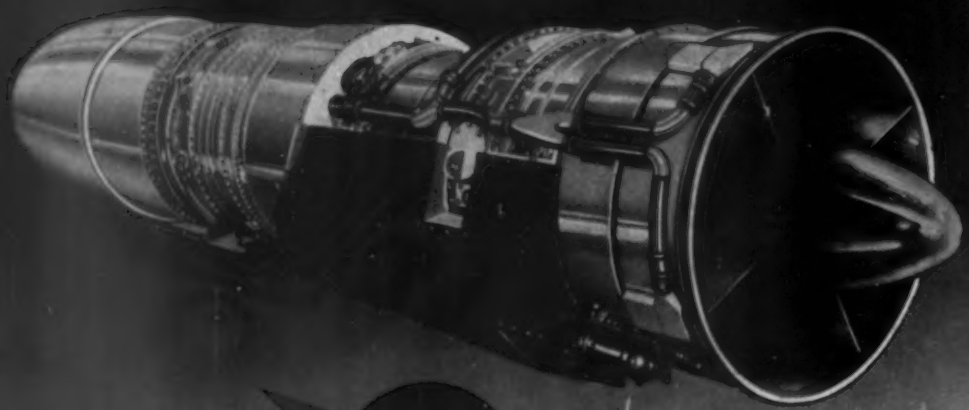
VERSATILE HAWKER HUNTER

High speed and manoeuvrability combine with varied payload to make the Hunter readily adaptable to operational service. In addition to 30 m/m cannon, it can carry bombs, guided missiles, rockets and extra fuel tanks.

From a painting by Roy Cross

HAWKER AIRCRAFT LIMITED • *Kingston-on-Thames and Blackpool, England* • *Member of the Hawker Siddeley Group* | *Pioneer . . . and World Leaders in Aviation*

FLIGHT TESTING THE NEW IROQUOIS AT MALTON



...for a well-defended future...
IROQUOIS,
Orenda's supersonic turbojet.

ORENDA *ENGINES LIMITED*
MALTON, CANADA
MEMBER: A. V. ROE CANADA LIMITED & THE HAWKER SIDDELEY GROUP

Enthusiasm for perfection

This is the keynote of the S.B.A.C. exhibition and display. Every year it's the same, for exhibitors and spectators alike. And in our own specialised fields, we at Marston's are enthusiasts for perfection. In the aircraft industry—and many others—Marston Excelsior equipment has a reputation for quality and efficiency. Whatever the job—flexible fuel tanks, heat exchangers, laminated plastics mouldings, light-alloy fabrication—Marston specialists approach it with an enthusiasm for perfection.

LATEST DEVELOPMENTS

* **'Marlite'* Flexible Fuel Tanks**
* **Titanium Heat Exchangers**
* **Components for Guided Missiles**

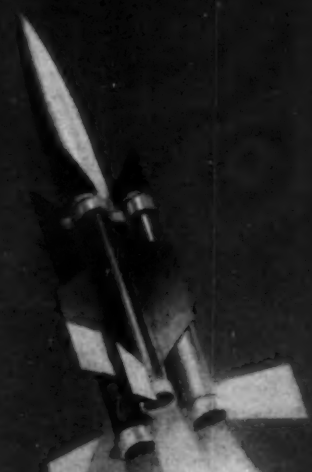
* *The new lightweight tank material*

MARSTON EXCELSIOR LTD.
Fordhouses · Wolverhampton
(A subsidiary Co. of Imperial Chemical Industries Ltd.)

MAR 224A

GRASEBY

THE FIRST NAME IN GUIDED WEAPON INSTRUMENTATION



DESIGNERS AND MANUFACTURERS OF:—

ELECTRICAL AND MECHANICAL INSTRUMENTS

Products include

LINEAR ACCELEROMETERS
ACCELEROMETER RECORDERS

Programme Units

BOOST SEPARATION SWITCHES
PLUG EJECTORS (*Pneumatic and Static Types*)
PRESSURE TRANSDUCERS
HIGH PRESSURE AIR VALVES
RATE GYROS • YAW METERS
SELECTOR SWITCHES
SELF DESTRUCTION UNITS
TIME DELAY SWITCHES

SPECIALISTS IN
GUIDED MISSILE AND TELEMETRY INSTRUMENTATION

Ask for details of our new range of GYRO TEST EQUIPMENT

GRASEBY INSTRUMENTS LTD.

KINGSTON-BY-PASS ROAD · TOLWORTH · SURREY

Telephone ELMBRIDGE 5742-3

In addition to the above we are the designers and manufacturers of a wide range of Precision Test Equipment including: Centrifuges with Precision Speed Control. Gyro Calibration Tables with Precision Speed Control. Precision Electric Stop Clocks and Recorders.

Contractors to Air Ministry, Admiralty, Ministry of Supply and Commonwealth Governments, A.I.D. Approval.

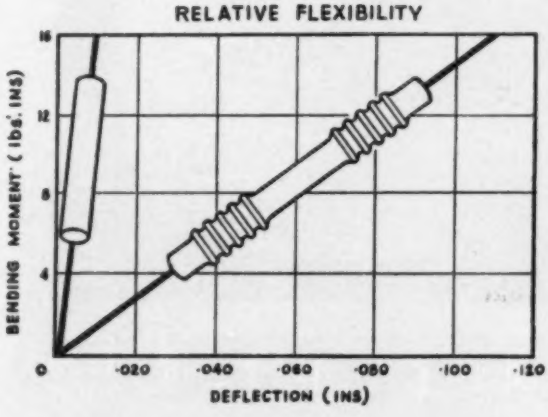
Overcome vibration fatigue

with

'HI-FLEX'

CORRUGATED STAINLESS STEEL PIPE ASSEMBLIES

with acknowledgements to Rolls-Royce Ltd.

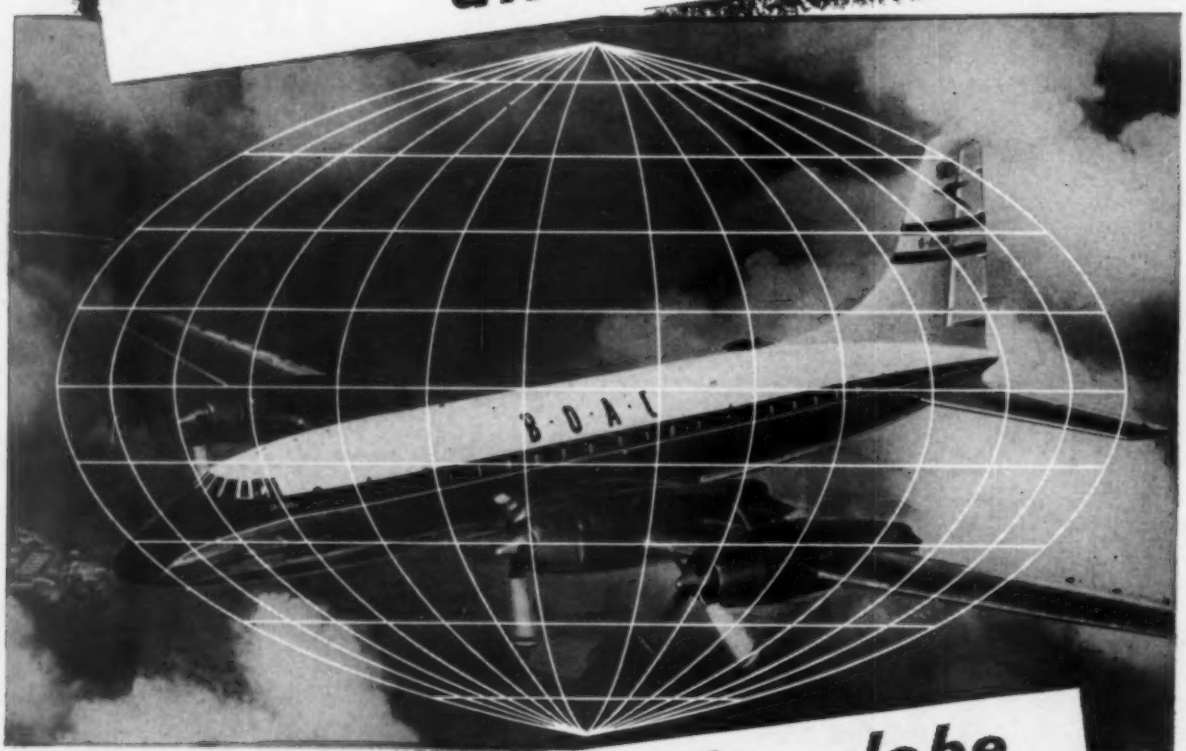


The Hi-Flex Organisation presents the successor to Rubber Hose Lines on applications of high temperature installation. Corrugated seamless stainless steel tube assemblies, completely stabilized, ten times as flexible as rigid tubing with no weight penalties. Vibration fatigue eliminated, wide temperature operating range, and will accommodate effects of thermal expansion. Available with Argon Arc welded or brazed end fittings.

OIL FEED ENGINEERING CO. LTD.

18 DENBIGH STREET . VICTORIA S.W.1

CORNERCROFT aircraft products



...encircle the globe

We make:—
DRILL AND ASSEMBLY JIGS
SHEET METAL STRUCTURES
MAJOR ASSEMBLIES
PRESS TOOLS AND PRESSINGS
METAL SPINNINGS
PLASTIC MOULDS AND MOULDINGS

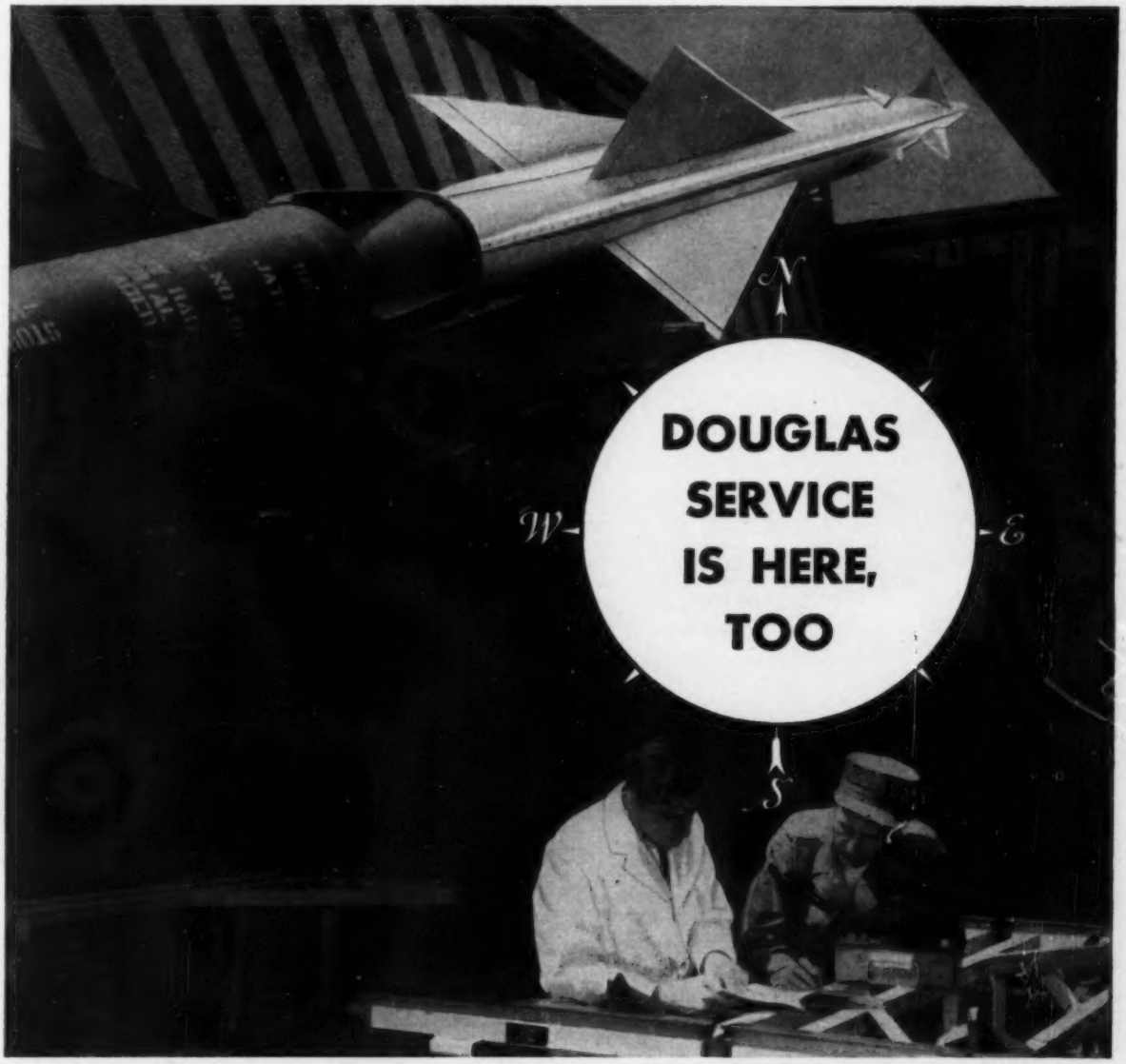
and we are equipped for:—
JIG BORING
KELLER WORK
SPECIAL PRECISION MACHINING
EXPERIMENTAL AND PROTOTYPE WORK

The
CORNERCROFT
GROUP OF COMPANIES

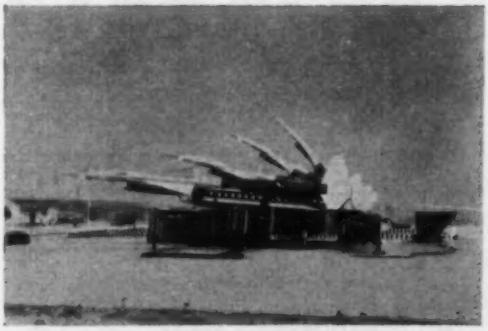
The Cornercroft Organisation is one of the oldest and most prominent contractors in the Aircraft Industry and provides the manufacturer with a complete, highly skilled and experienced engineering service—it is at your disposal—can we help you?

DESIGNERS AND MANUFACTURERS OF AIRCRAFT COMPONENTS FOR NEARLY 40 YEARS

CORNERCROFT LIMITED, ACE WORKS, COVENTRY. *Telephone : Coventry 40561*
and at **32 CLARGES STREET, PICCADILLY, LONDON, W.1.**
Subsidiary Companies : THE METAL SPINNING COMPANY LIMITED. CORNERCROFT (PLASTICS) LIMITED. JAMES BERESFORD & SON LIMITED.



Wherever batteries of Douglas-built Nike missiles are set up, Douglas on-the-spot service ensures their combat readiness



Nike must defend against targets travelling at supersonic speeds. Precision adjustment and performance are vital to accuracy at such speeds.

At the many Nike installations which now ring key U.S. cities and bases Douglas Field Service representatives are on the scene or within easy reach.

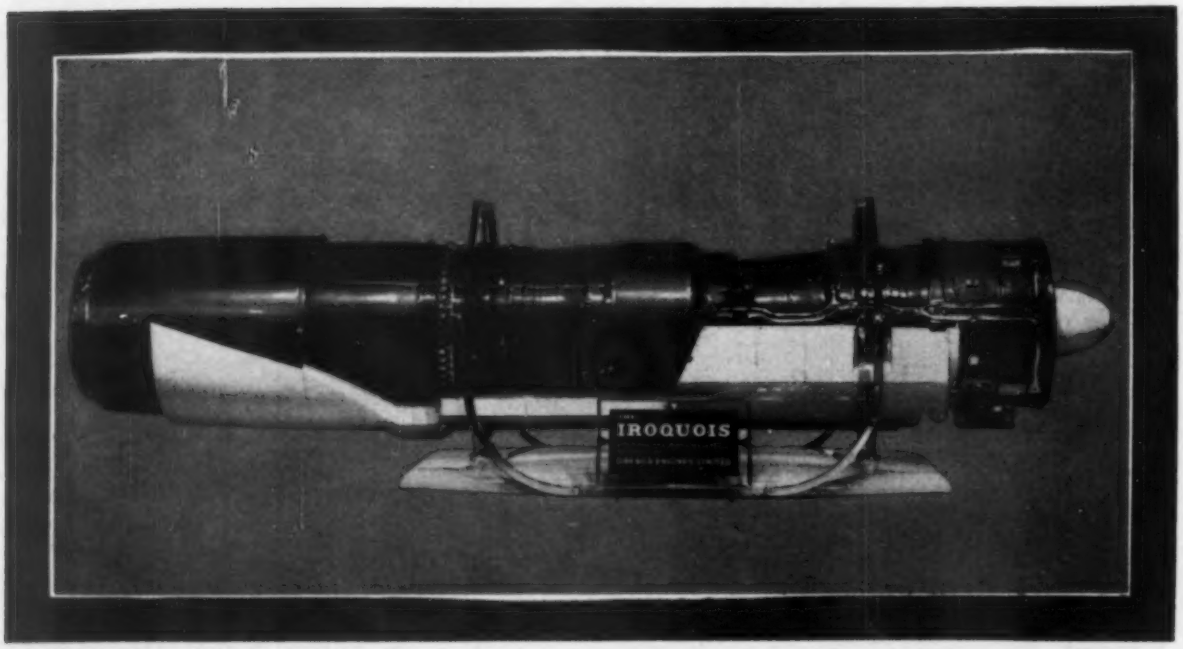
A staff of well over 100 perform such services, bringing to bear the full support of the Douglas organization on any problems which may arise.

Wherever Douglas aeroplanes or missiles may be, whether their mission is military or commercial, Douglas Field Service men are on hand to facilitate their maximum utilization. Douglas backs its equipment with service and spare parts on a permanent basis, years after its delivery to the customer.

Depend on DOUGLAS Service

..."NEW TITANIUM ALLOYS"...

..."achieve the lightness of weight which is so important and is such an outstanding feature of this high thrust engine."
—quotation from address by the Honourable George R. Pearkes, Canada's Minister of National Defence.



CSI *is proud to have played a part in the development of the*

IROQUOIS

Fabricators of aircraft components for Canadian and U.S. manufacturers.

CSI

CANADIAN STEEL IMPROVEMENT LIMITED

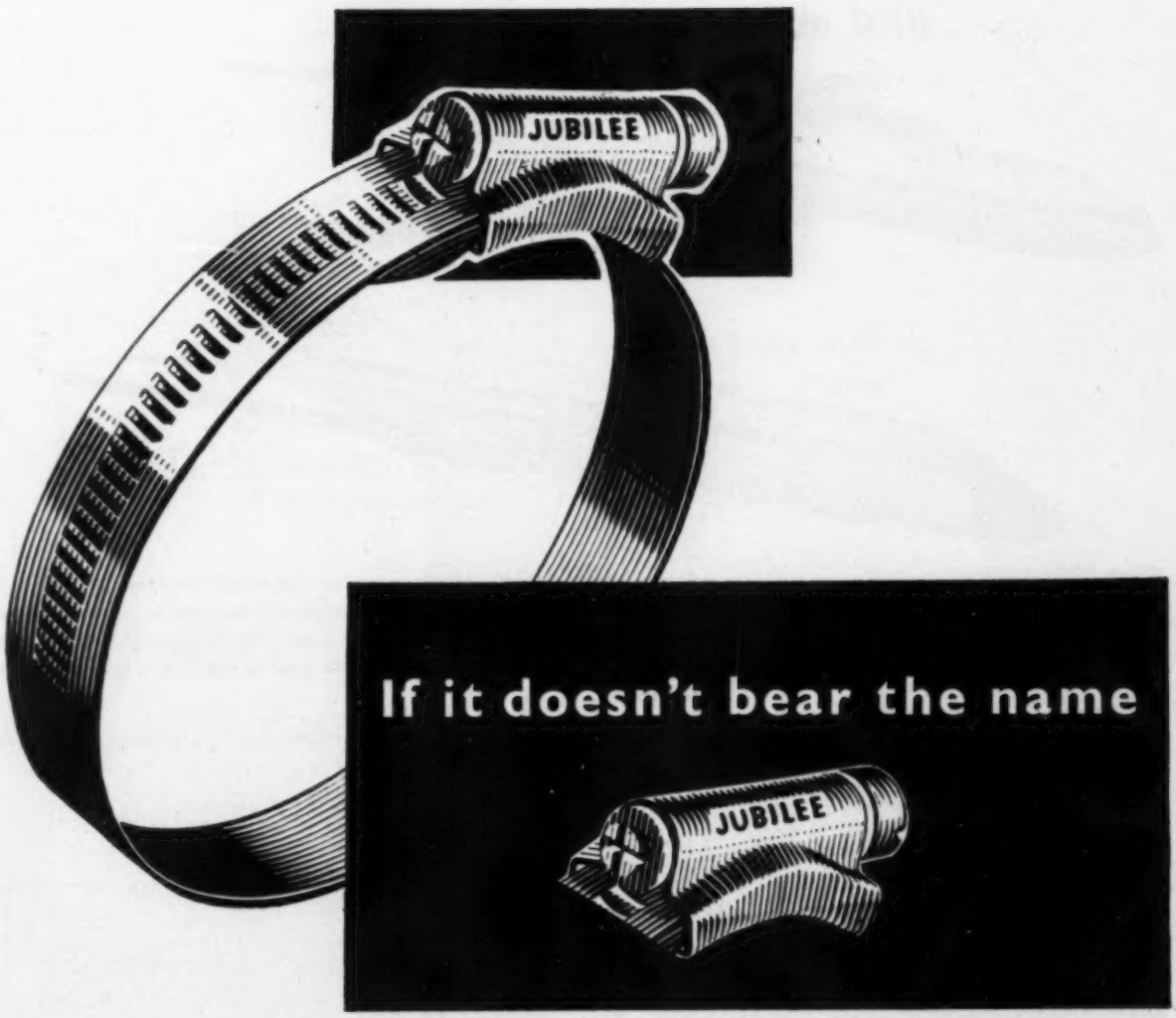
289 HORNER AVENUE
ETOBICOKE, ONTARIO

Forgings in Steel,
Aluminum,
High Temperature Alloys,
Titanium
Castings in Aluminum
and Magnesium

Represented in the United States **Only** by—
C. F. RUSSELL COMPANY INC.
BAY SHORE, NEW YORK

5714

If it doesn't—*it can't be*



it can't be a genuine *Jubilee* CLIP
REGD. TRADE MARK

Famous in Four Reigns

L. ROBINSON & CO. (GILLINGHAM) LTD., LONDON CHAMBERS, GILLINGHAM KENT., TELEPHONE 5282

The Kidde Passenger Oxygen System

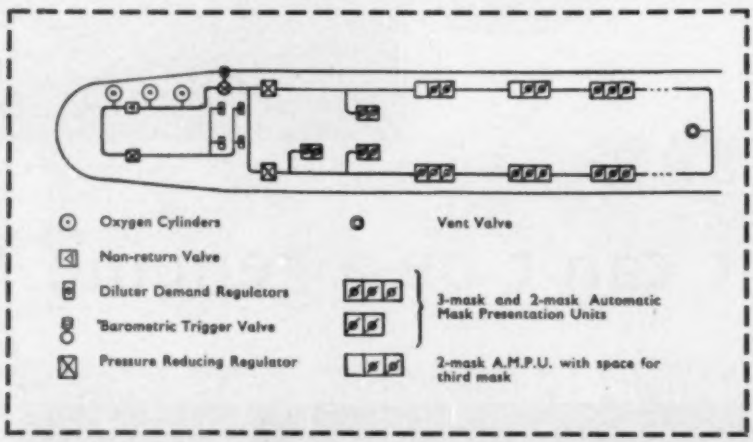
designed for the COMET IV and BRITANNIA

Photographs by courtesy of The de Havilland Aircraft Co. Ltd., and The Bristol Aeroplane Co. Ltd.

Introducing for the first time in actual service a fully automatic emergency system for passengers. The system is automatically brought into operation by means of barometric valves which release oxygen masks from stowages fitted above the heads of passengers. By pulling the mask to the face, a flow of oxygen is turned on.

Approximate all-up weight of system including storage cylinders and oxygen is 2 lb. per passenger.

Designed and developed to meet present C.A.A. regulations.



K Kidde

THE WALTER KIDDE COMPANY LTD.

(In association with the Scott Aviation Corporation of America)

Belvue Road, Northolt
Middlesex

Telephone: Waxlow 1061

CREATIVE ENGINEERING IS THE FOUNDATION OF KIDDE PROGRESS

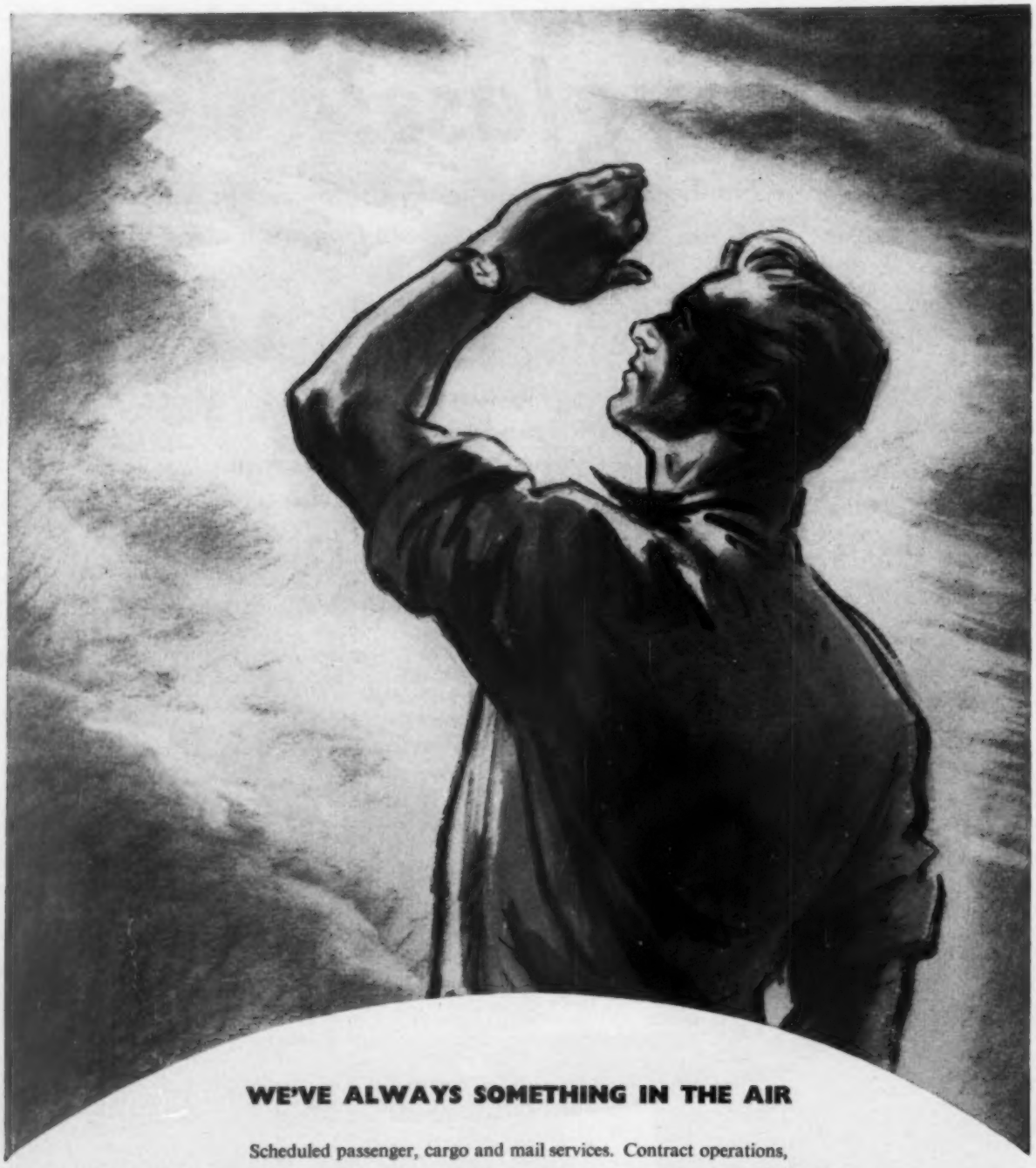
Flybyglass?

Frankly, we can't think of any British aircraft without its Fibreglass in one form or another.

4
1 Fibreglass insulation of electric cables.
2 Fibreglass superfine fibre insulates the fuselage, held in position by Fibreglass tying cord.
3 Radomes and aerial panels in Fibreglass Reinforced Plastics.
4 4 Wing and rudder tips in Fibreglass Reinforced Plastics.
5 De-icing panels in the wings in flat Fibreglass Reinforced Plastics.
6 Ducting in Fibreglass Reinforced Plastics.
7 Fibreglass-impregnated cloth gaskets for double-glazing.
R.A.F. BENEVOLENT FUND 67 PORTLAND PLACE LONDON, W.1.
2
1
6
4
5
3
7
4

For strength with lightweight
For thermal, sound and electrical insulation **FIBREGLASS** (TRADE MARK)

FIBREGLASS LIMITED, ST. HELENS, LANCASHIRE St. HELENS 4224



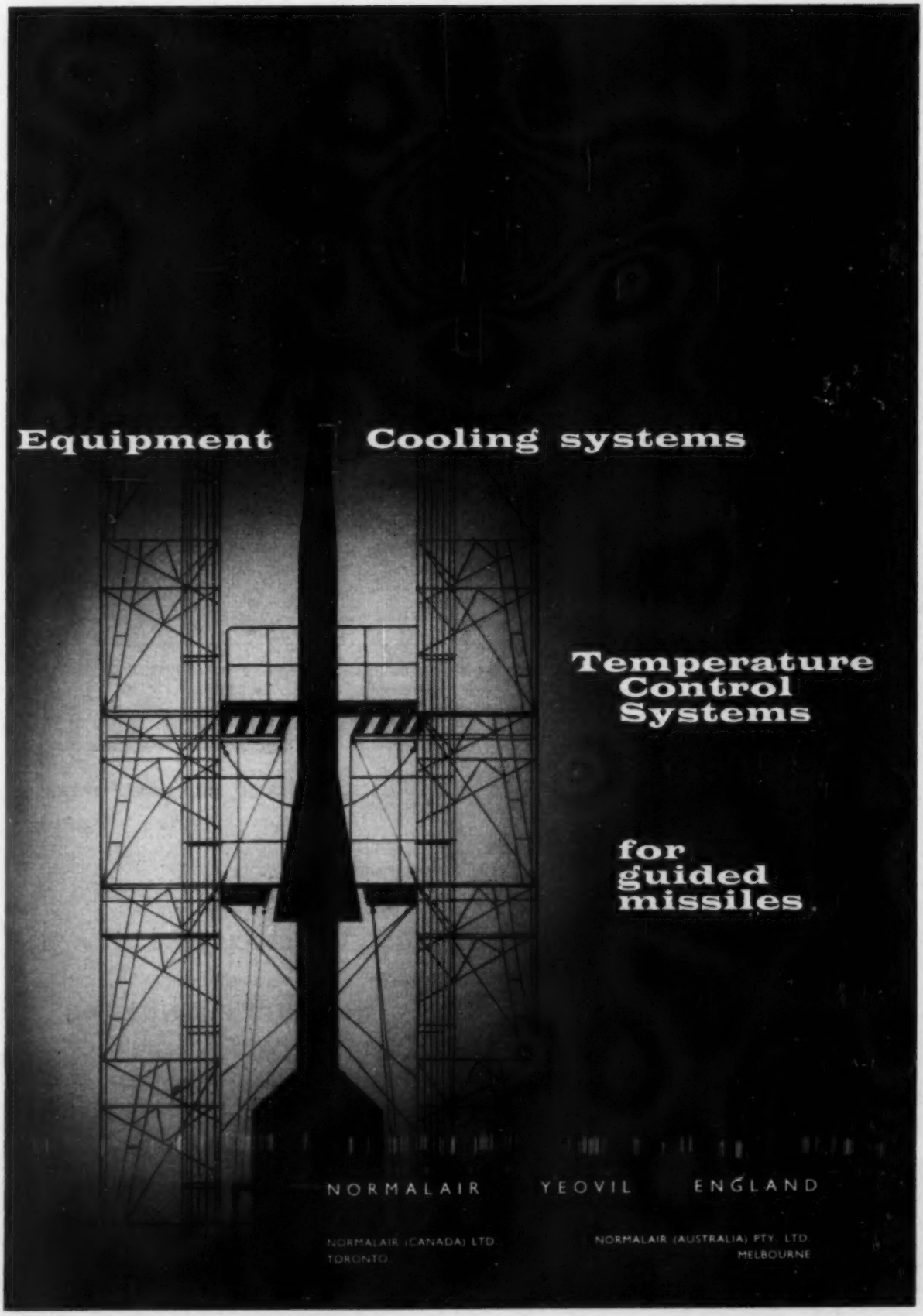
WE'VE ALWAYS SOMETHING IN THE AIR

Scheduled passenger, cargo and mail services. Contract operations,
helicopter operations, aircraft maintenance and modification. Overseas based operations.
Aerial crop spraying. The Airwork School of Aviation.
Aircraft sales and purchase. Spare parts sales and purchase. Radio installation and maintenance.
Aircraft catering, flying club operation, and aircraft insurance.

AIRWORK LIMITED

AIRWORK HOUSE, 35 PICCADILLY, LONDON, W.1 TELEPHONE REGENT 8494

G&G


Equipment
Cooling systems
Temperature
Control
Systems
for
guided
missiles
NORMALAIR YEOVIL ENGLAND
NORMALAIR (CANADA) LTD.
TORONTO
NORMALAIR (AUSTRALIA) PTY. LTD.
MELBOURNE

TEDDINGTON AIRCRAFT CONTROLS LIMITED

•

Designers and manufacturers

of

control equipment fitted to the majority

of the aircraft operating today with the

Royal Air Force

Give for those who Gave
Thousands of our finest men and women in the Royal Air Forces have given their service, their health, and in many cases, their lives for their Country and in defence of Freedom. Today many of them and their dependants, are in urgent need of the R.A.F. Association's Welfare Service. Please give all you can for the emblem on Wings Day or send a donation direct to Headquarters
WEAR THIS EMBLEM ON
WINGS DAY
SATURDAY, SEPTEMBER 14th
ROYAL AIR FORCES ASSOCIATION, 43, Portland Place, W1
Incorporated by Royal Charter
Registered under the War Charities Act, 1940
PROCEEDS TO BE DEVOTED TO CHARITABLE AND WELFARE PURPOSES

Teddington CONTROLS

REGD. TRADE MARK

TEDDINGTON AIRCRAFT CONTROLS LTD. MERTHYR TYDFIL, SOUTH WALES Telephone: Merthyr Tydfil 666

LONDON OFFICE : Colnbrook-By-Pass, West Drayton, Middlesex. Telephone: Colnbrook 502

SUPER LUXURY HIGH DENSITY

RUMBOLD

WEIGHT 49 lbs.

DESIGNERS AND MANUFACTURERS

OF

AIRCRAFT SEATING

SPECIALISTS

IN

INTERIOR FURNISHING

AND

SOUNDPROOFING

L. A. RUMBOLD & Co. LTD.

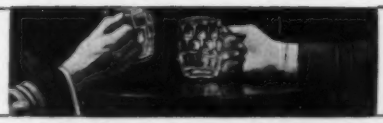
KILBURN, LONDON, N.W.6

Tel.: MAlda Vale 7366-7-8

I'm fed up with filters!
let's sit down...

Let's sit down and talk about cricket, the weather... anything so long as it isn't your confounded Simmonds Fram Separators.

Sorry old man... didn't mean to bore you.



That's quite all right. Delighted to know the R.A.F. is getting up to date. So you actually fly your planes on kerosene now instead of water!

Very comical! Anyway, it's not the whole point. I admit the main object of Simmonds Fram Separators is to remove all the water, but they also take out the solids.

Little strips of erk, for instance?

... Anything down to 5 microns.

That gives me a big kick.
Which is more than I can say for this brew...

There you are. Now if we could persuade Sally to fit Simmonds Water Separators to the barrels...

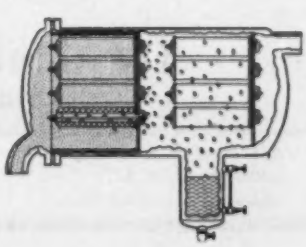
the point of the argument... **FRAM SEPARATOR FILTERS** for clean water-free fuel

For more details of this and other Simmonds products for the aviation industry **SEND FOR LITERATURE** *to*

SIMMONDS AEROCESSORIES LTD.
Byron House, 7-8-9, St James's Street, London, S.W.1.

Head Office & Works: Treforest, Pontypridd, Glamorgan.
Also Birmingham, Manchester, Glasgow, Stockholm, Copenhagen, Ballarat, Sydney, Johannesburg, Amsterdam and New York.

A MEMBER OF THE FIFTH CLEVELAND GROUP FC



CBC 5W3

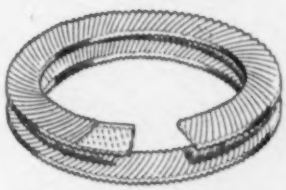
RISTS
CABLES... play their part
in the
AVRO
SHACKLETON
M.R.3
Photograph by kind permission of A. V. Roe & Co. Ltd.
In addition to a wide range of cables we specialise in the production of many forms of cable assemblies for the Aircraft Industry, incorporating moulded harness plugs. Sockets, bifurcations etc., a speciality.
RISTS WIRES & CABLES LTD LOWER MILEHOUSE LANE • NEWCASTLE • STAFFS

Take a holiday from your raw material worries
by dealing with the RAPP GROUP
THE RAPP GROUP OF COMPANIES
60a Purley Avenue, London, N.W.2.
GLAdstone 6393-4-5-6-7-8
Prompt delivery of ALL METALS including sheets, strips, rods, sections, tubes, in: ALUMINIUM and its ALLOYS, BRASS, COPPER, MILD STEEL, BLACK PLATES, TIN PLATES, A.I.D. RELEASED AND COMMERCIAL.

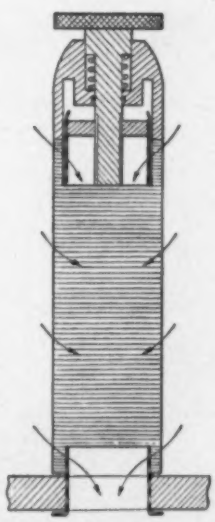
RELLUMIT

Aircraft Refuelling Equipment by "RELLUMIT"

- Rellumit introduce their new range of microfilters and coarse filters.
- The principle of filtration is based on a series of calibrated pore-size grooves of conical shape fitted on both surfaces of the plastic discs to give whatever degree of filtration required.
- The filter is built up by a series of candles fitted with the new calibrated pore-size plastic discs according to the flow required.
- The range of filtration on the new filters is as follows: 5 microns, 10 microns, 20 microns, 50 microns, 75 microns, 100 microns, 150 microns, 200 microns, 300 microns.
- Spares are no longer required when the filter is clogged. A single back-flushing operation or any other means of cleaning available is only required. Therefore giving a considerable saving in maintenance cost.



Cutaway section through plastic disc



Section through single candle element

Also manufacturers of—

Aircraft Refuelling Microfilters • Aircraft Refuelling Equipment • Pressure Flow Controllers • Telescopic Refuelling Arms • Bulk Storage Microfilters • Hand Drawn Servicers • Motorized Servicers • Engine Microfilters • Water Separators • Coarse Filters • Loading Arms • Air Eliminators

Germany
Rellumit-Buro
Francfort-Kronberg
Faudi-Feinbau
Oberursel
HEYNE G.m.b.H.
Offenbach/a/Main

Italy
Rellumit sede Roma
Rome

Spain
Rellumit Delegacion Espana
Madrid

France
Rellumit
La Garenne Colombes

Belgium
"SCAPI"
Vilvorde

Sweden
Belos
Stockholm

Argentina
Beuret
Buenos-Aires

Canada
Noropoint Ltd.
Montreal

RELLUMIT (LONDON) LIMITED, Chandos House, Palmer Street, LONDON, S.W.1.

Telephone: ABBey 3304

Actual test studies have proved

15 to 58% WEIGHT SAVING

with Avlok Blind Anchor Nuts

No wonder the aircraft industry is making more and more use of Avlok Blind Anchor Nuts! As actual tests have proved, they show a 15 to 58% weight saving over comparable fastening systems, cut production time, save money, and completely eliminate the need for riveted anchor nuts, threaded inserts and sheet tapping.

Available in standard threads, Avlok Blind Anchor Nuts not only bolt components together where only one side of the job is accessible—they can be easily detached and replaced whenever required.

In the aircraft industry, this revolutionary fastening system is the effective answer to many problems—we will be glad to supply you immediately with fully detailed weight studies.

Just look at the other advantages:

- Rapidly fixed from one side
- Lightweight
- Absolutely shakeproof
- Simple to replace
- No jig drilling or riveting
- Enormous advantage to designers

AVLOK *Blind* **ANCHOR NUTS**

AVIATION DEVELOPMENTS LTD., 229-231 HIGH HOLBORN, LONDON, W.C.1.

$$\int_{1939}^{1957} \text{I.H.F} = 10^5 + \text{Constant reliability}$$

NEARLY 100,000 Type I.H.F. pumps have been manufactured by Integral Limited over the past 18 years. Thousands continue to give reliable service The latest to fit I.H.F. feathering pumps is the Handley-Page Herald "Branch Liner"

INTEGRAL LTD

Birmingham Road · Wolverhampton · Tel: Wolverhampton 24984

21 Years leadership in aircraft hydraulics

With a
touch of pride ...
We feel justly proud in having manufactured the prototype main engine cowling, the production line rear cowling door assemblies, oil systems and oil cooler mounting panels.
We shape the things to come

The Abbey Panel & Sheet Metal Co. Ltd.

BAYTON ROAD,
BEDWORTH,
Nr. COVENTRY.
Telephone: BEDWORTH 2071/4

also at
OLD CHURCH ROAD,
LITTLE HEATH,
COVENTRY.
Telephone: COVENTRY 89461

Experts in high class shape panel work Aircraft fabrications and assemblies

B

Introduced at the Show – This light-weight aircraft handler by M.L.

Incorporating an entirely novel method of moving large aircraft, this M.L. Handler makes stowing aircraft on deck or on apron as easy as pushing a small trolley.

Write for full technical information or for a practical demonstration.

& the COOLAIR Mk.5, latest M.L. cabin cooling unit

This new Coolair is capable of cooling the cabin interior and equipment compartments of modern service aircraft.

Equipped with three ducts, it supplies cool, conditioned air from one at 10 lb. per minute and from two at 45 lb. per minute each.

Refrigeration capacity 120,400 B.T.U. per hour.

M L AVIATION COMPANY LTD

WHITE WALTHAM AERODROME, MAIDENHEAD, BERKS.

Telephone : LITTLEWICK GREEN 248 *Telegrams : 'EMELAIR' WHITE WALTHAM.*

FABRICATION BY FORD

Frank Ford (Aircraft Components) Ltd. maintains a modern sheet metal factory and a fully equipped machine shop for fabrication and precision machining of forgings, components and assemblies. Ford fabrications have proved themselves in many of the world's most famous aircraft and aircraft engines—including the Rolls-Royce NENE 103. Should you have any fabrication problems the Company's wide experience is at your disposal. Write for details:—

FRANK FORD AIRCRAFT COMPONENTS LTD

All enquiries to Registered Office: SOVEREIGN WORKS, LISTER LANE, HALIFAX, YORKSHIRE.
Telephone: Halifax 66361 (4 lines)

British MonoRail handling equipment which includes track, trolleys, switches, tractors, bridge cranes and jib cranes, covers an industry-wide field.

Backed by 30 years technical experience from our Associates, the American MonoRail Company, flexibility in the initial design allows handling systems to cater for almost any type of processing.

Fully automatic overhead handling systems, with a wide variety of control possibilities, can be engineered to provide for the selective despatch or loading and delivery of bulk and batch materials between multiple stations.

BRITISH MonoRail LIMITED

All enquiries to:

BRITISH MONORAIL LIMITED

WREN WORKS · CHADDERTON · LANCS

Telephone: MAin (Oldham) 6883. Telegrams: "MonoRail" Oldham.

Associates of American MonoRail Company, Cleveland, Ohio.

A1

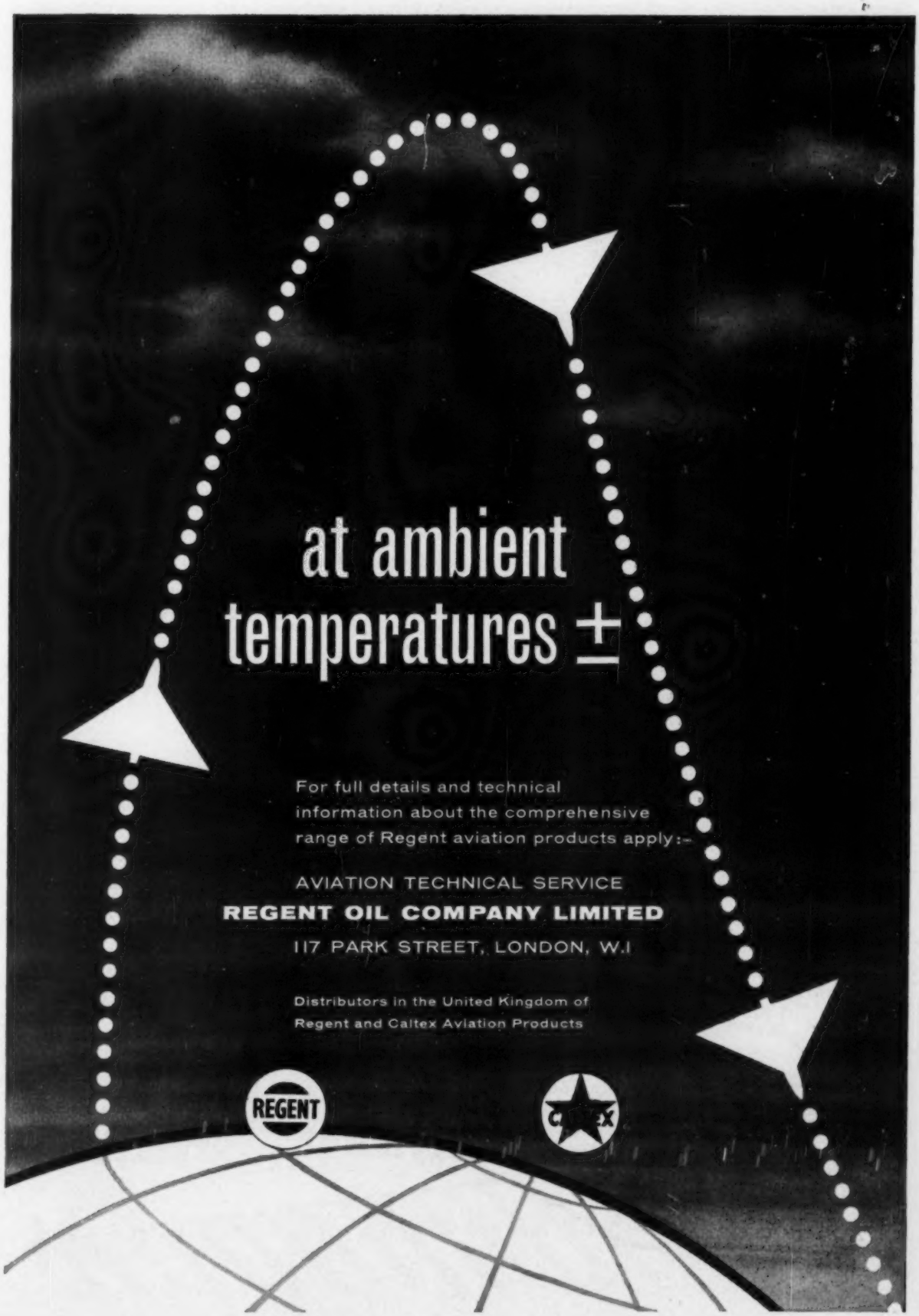
Stream-Line
filters
for aviation fuel
filtration

STREAM-LINE FILTERS

STREAM-LINE FILTERS LTD.
A Member of the VOKES Group
INGATE PLACE · LONDON · S.W.8
Tel: MACaulay 1011

Used by the R.A.F. and U.S.A.A.F. in Great Britain and by military air forces all over the world. Other users include leading aircraft manufacturers and oil companies.

SF113


at ambient
temperatures ±
For full details and technical
information about the comprehensive
range of Regent aviation products apply:-
AVIATION TECHNICAL SERVICE
REGENT OIL COMPANY LIMITED
117 PARK STREET, LONDON, W.1
Distributors in the United Kingdom of
Regent and Caltex Aviation Products
REGENT

PRECISION SHEET METAL FABRICATION
in heat-resisting alloys of
Combustion Components
for the
GAS TURBINE ENGINE INDUSTRY

FLAME TUBES · EXHAUST UNITS
JET PIPE ASSEMBLIES · DISCHARGE
NOZZLES · COMBUSTION CHAMBER
HEAT SHROUDS · REAR NOZZLE
BOX PANELS · FIRE-WALL UNITS · ETC.

First-class development, production and repair facilities offered to manufacturers.

A.I.D. and A.R.B. approved

BURNLEY AIRCRAFT PRODUCTS LIMITED
FULLEDGE WORKS - BURNLEY - LANCASHIRE - ENGLAND
Telephone: 3121/2 and 3207 Burnley (3 lines). Telegrams: "AIRCRAFT" Burnley.
REPAIR DIVISION: GROSVENOR STREET, STONEYHOLME, BURNLEY. Telephone: 3184
Associated with RENFREW AIRCRAFT & ENGINEERING CO. LTD., RENFREW, ONTARIO, CANADA

Your exports . . .
never out of expert hands

Hand it to KLM! They give every consignment a flying start. KLM's air freight service is the most complete ever known. Send your exports safely away in the capable, trustworthy hands of KLM.

Route your exports via KLM through your Freight Agent or KLM Royal Dutch Airlines, 67 Clerkenwell Road, E.C.1. Tel: Mayfair 8803; and at Birmingham, Manchester, Glasgow and Dublin.

Photograph by CYRIL PECKHAM F.R.P.S.

C O N F I D E N C E

Her last hand hold gone, parachuting instructress Sue Burges calmly counts off the seconds before pulling her ripcord. Between her and the ground, which is only 13 seconds away, is a G.Q. Blank-Gore steerable parachute—internationally acknowledged to be the finest equipment of its type in the world.

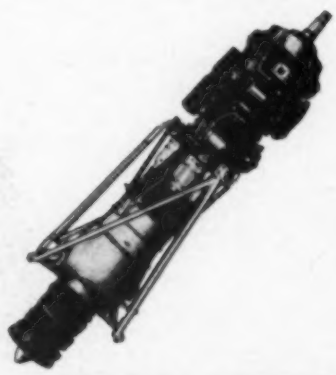
Week after week, summer and winter, G.Q. parachutes are used within sight of the factory in which they are made—a reminder to us (as if we needed it!) that the lives of human beings are in our hands.

We agree that a G.Q. parachute is comfortable to wear, but in an emergency, it is also good to know that it is DESIGNED FOR USE.

LEADERS IN PARACHUTE DEVELOPMENT

G.Q. PARACHUTE CO. LTD · STADIUM WORKS · WOKING · SURREY · ENGLAND · TEL. WOKING 2277

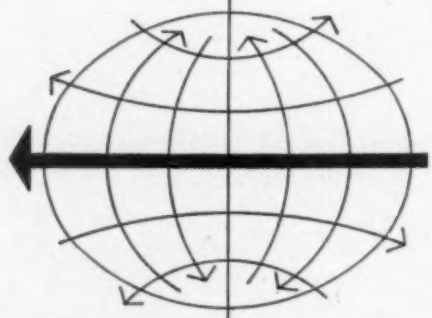
ELAND (for fixed wing aircraft) propeller-turbine engine for new airliners and conversion of piston engine airliners to propeller-turbine power. Chosen for the Hamburger Flugzeugbau C209 and the Convair 340.



ELAND (for helicopters) specially designed for the Fairey Rotodyne, is basically the standard Eland with an auxiliary compressor mounted at the rear. A further design with a rear gear box is installed in the Westland Westminster helicopter.

ORYX turbo gas generator designed for helicopters where the rotor is propelled by jet reaction at the blade tips.

NAPIER AERO ENGINES



for the world

SCORPION an aircraft rocket engine which provides a source of extra power at high altitude. Designed for sustained firing and long operational life.

GAZELLE free turbine engine designed primarily for helicopter propulsion. Chosen for the Westland Wessex and the Bristol 192. Can be adapted for fixed-wing applications.

TIP THRUST UNITS for helicopters restore performance lost through heat, humidity and height. In operation in the Saunders Roe Skeeter.

D. NAPIER & SON LIMITED—LONDON, W.3. Member of the ENGLISH ELECTRIC Aviation Group

CRC 8.36

FIRST AERONAUTICAL WEEKLY IN THE WORLD FOUNDED 1909

FLIGHT
and
AIRCRAFT ENGINEER

No 2538 Vol 72 FRIDAY 13 SEPTEMBER 1957

Editor
MAURICE A. SMITH D.F.C. AND BAR

Associate Editor
H. F. KING M.B.E.

Technical Editor
W. T. GUNSTON

Production Editor
ROY CASEY

Iliffe and Sons Ltd.
Dorset House
Stamford Street
London, S.E.1
Telephone · Waterloo 3333

BRANCH OFFICES

Coventry
8-10 Corporation Street
Telephone · Coventry 5210

Birmingham
King Edward House, New Street, 2
Telephone · Midland 7191 (7 lines)

Manchester
260 Deansgate, 2
Telephone · Blackfriars 4412 (3 lines)
Deansgate 3595 (2 lines)

Glasgow
26B Renfield Street, C.2
Telephone · Central 1265 (2 lines)

Toronto, Ontario
Thomas Skinner of Canada, Ltd.
67 Yonge Street, 1
Telephone · Empire 6-0873

New York, N.Y.
Thomas Skinner and Co. (Publishers), Ltd.
111 Broadway, 6
Telephone · Digby 9-1197

ANNUAL SUBSCRIPTION
Home and Overseas · Twelve Months, £4 10s. U.S.A. and Canada, $14.00

Entered as second-class matter at Post Office, New York, N.Y.

In this issue

426 From All Quarters
428 Here and There
429 Farnborough Week
437 Anglo-American Conference
439 The Static Show
458 Aviation Artists' Exhibition
460 Civil Aviation
464 Service Aviation
466 Correspondence
467 The Snow-white Bird

Diehard Fighters

HAVING regard to the supposed imminent demise of the manned fighter this was, remarkably enough, very much a "fighter" Farnborough. It was, indeed, a proclamation that Great Britain, after sundry post-war lapses and failures, is showing high promise of regaining the supreme position wherein she established herself in the late 1930s. In those now-distant days the Spitfire and Hurricane—even when established in R.A.F. service—showed a very definite superiority in all-round performance and fire power over the most recent prototypes of foreign makers; and it is well within the bounds of present possibility that the English Electric P.1 and SR.53 (largely by virtue of their own technical merits but in part because of shortcomings in foreign competitors) will attain a similar eminence. Such is their promise, indeed, that there is a fast-growing belief (or at least a more openly professed one) that the P.1 is not by any means the final manifestation of British fighter technique. In this regard the Scorpion-Canberra's new world record of 70,000ft has a particular significance, for it is a direct measurement of the increments in altitude now feasible with auxiliary rocket power.

For work at the lower levels we shall have the Hawker P.1121, which has very much of the fighter in its make-up, though its primary mission will be the attack of ground targets. Itself a private venture, the P.1121 is allied, in its challenging bid for national and international acceptance, with de Havilland's Gyron turbojet —now sadly bereft of State support. Conversely, the Orenda Engines Iroquois, for the Avro Aircraft Arrow intercepter, is a Government-sponsored engine, and one which bids fair to win a place in other fighters—British, American or Continental—which even yet may come to pass.

SR./A.1/53

IT is required of a good test pilot that he should state his findings and opinions with decision, clarity and succinctness. In this regard, as in others, John Booth of Saunders-Roe, who demonstrated the SR.53 mixed-power intercepter at Farnborough last week, rates an "A.1" assessment. More appropriately, the rating should be "SR./A.1," in honoured memory of Mr. Booth's former chief, Geoffrey Tyson, who likewise made Farnborough history in a Saunders-Roe fighter of brilliant and unorthodox design—and one which will always be remembered by that designation.

The A.1 rating is surely merited by John Booth's considered appraisal of the SR.53, in answer to an inquiry at the S.B.A.C. dinner. "Well, it flies faster than the——," he said (naming a mighty missile), "and it flies farther. Usually it gets back home; and its electronic system weighs 200 lb and drinks gin."

Add to these propensities the likelihood that the new fighter (which itself has a partiality for high-test peroxide with a dash of kerosine) will achieve Mach 2 or better, and take altitudes of over 90,000ft in its stride, and it will be apparent that Saunders-Roe have come out with a very remarkable aeroplane indeed. In its successive developments (and contingent, of course, on continued M.o.S. support) it gives hope of important applications in the Royal Navy and foreign air forces.

Whether the "packaged" rocket installation, typified by Napier's "sawn-off" double-barrelled Scorpion, and applicable to basically turbojet fighters such as the English Electric P.1, will offer too strong a challenge remains to be seen; and certainly the acquisition by the American Aerojet General organization of the Scorpion licence is not without significance.

But should destiny hold no more for the SR.53 than it held for the SR./A.1, its makers are none-the-less to be congratulated on their demonstrated ability to build a world-leading intercepter fighter just as well as they build mammoth flying-boats and tiny helicopters.

We sincerely hope that neither Mr. Booth nor his rocket will ever go thirsty.

FROM ALL QUARTERS

Comet's Atlantic Crossing

A COMET of No. 216 Squadron, R.A.F. Transport Command, was due last Wednesday to make the first non-stop East-West crossing of the Atlantic by an aircraft of this type. Captained by F/L. Gordon K. Senior and carrying 28 members of the R.A.F. advance ground-crew party for the Strategic Air Command's bombing competition—referred to on page 464—the Comet's flight-plan schedule was as follows (all times G.M.T.): leave Aldergrove 3.45 a.m., arr. Gander 9.45 a.m.; leave Gander 11.45 a.m., arr. Pinecastle A.F.B., Florida, at 4.30 p.m.

The Air Ministry was "unable to comment" on suggestions earlier this week that the Queen should fly to America next month by R.A.F. Comet 2.

SC.1 Vertical Tests

AT Belfast on September 5 the Short SC.1 research aircraft, which did not appear at Farnborough because it was not possible to interrupt its development programme, began to undergo tests of its vertical lift engines. These trials are preparatory to the tethered vertical take-off and hovering trials which are soon to take place in a gantry erected by Short Brothers and Harland, Ltd.

This gantry, in the company's description, "provides a three-dimensional envelope of freedom for the hovering aircraft" and at the same time limits its rate of descent in an emergency. The gantry incorporates a cable system which limits the SC.1's zone of flight within the superstructure; though it does not in any way assist or support the aircraft, which rises and descends under its own power.

The steel platform of the gantry has an openwork floor so that the heat from the Rolls-Royce R.B. 108 turbojets—four out of five of which are used for vertical lift—can be safely expelled.

B.O.A.C. Speaks Out

THE B.O.A.C. press conference last Monday, at which the year's trading results were revealed, was outspoken to an unprecedented degree. The statements about the Britannia which B.O.A.C.'s chairman, Mr. Gerard d'Erlanger, allowed to go on record were clearly made in full knowledge of the likely journalistic reaction which, in the event, followed. Before these statements are recorded, it is appropriate to summarize the main results of B.O.A.C.'s operations in 1956-57. The most important result is the net profit of £303,352. (A probable deficit in the current year is predicted.)

	1956–57	1955–56
Profit before remuneration of capital	£1,776,027	£1,295,525
Profit (net) after remuneration of capital	£303,352	£117,731
Total Revenue	£49,004,711	£42,706,582
Total Expenditure	£48,701,359	£42,588,851
Percentage increase in capacity produced	10.8 per cent	14.3 per cent
Average overall load factor	63.7 per cent	61.7 per cent

It will be remembered that in June 1956, one month after Mr. d'Erlanger followed Sir Miles Thomas into office, the new chairman forecast a deficit in the year ahead of £1½ million. This forecast was made before the unforeseen series of events that led to three postponements of Britannia 102 services—delays which cost B.O.A.C. a "substantial" sum (a figure of £1¼ million has been unofficially mentioned) in costs and lost revenue. Nor could Mr. d'Erlanger's forecast have anticipated the effects of the Government's credit squeeze (which B.E.A. cited as a reason for their reduced profit this year). The difference between Mr. d'Erlanger's forecast and the final net profit—a discrepancy amounting to nearly £2 million—is officially accounted for by a two per cent increase in load factor.

Without the Britannia 102 delays, and the credit squeeze, Mr. d'Erlanger's estimate might have been as much as £3 million out—an indication of the dubious wisdom of making such forecasts.

The remarks made about the Britannia were in reply to questions prompted by a letter from Mr. Basil Smallpeice, B.O.A.C.'s managing director, delivered to the Corporation's staff coincidentally with news of the year's results. Mr. Smallpeice, after complimenting the staff on the year's effort, wrote:—

"We originally hoped to put the Britannia 312 into service last April. But delivery dates have repeatedly gone back, and it is now plain that we cannot start putting them into service until next year.

"Now, delay in getting a single Britannia 312 into service involves us in loss at the rate of about £½ million a year if the aircraft is replacing one of our older types, or in loss at the rate of about £¼ million a year if the aircraft is to provide extra capacity for carrying additional traffic. Even if the delivery dates we now have from the manufacturers are in fact met, we estimate that our results in this current year will be well over £2 million worse than they might have been. That is the measure of the financial damage which late deliveries by manufacturers do to us. And faced with that sort of cost (which . . . can never be shown up anywhere in our accounts) it will not be surprising if we come out with a deficit this year.

"But although the financial penalties are severe for not immediately putting the Britannia 312 into service when we get it, we must first establish whether it is liable to encounter on the Atlantic or near the eastern seaboard of North America the same kind of engine icing that is still being experienced with the Britannia 102 on the Eastern and African routes. . . . We must, therefore, spare no effort and no cost to satisfy ourselves as far as we can on this point before we commit the aircraft to passenger service.

"The problems of the Britannia—and engine icing in particular—overshadow most of our thoughts and hopes at the present time. Basically, the Britannia is a fine aircraft. But, to date, there is no cure to the air intake icing difficulties of the powerplant in certain conditions. In addition, we have encountered a whole series of unrelated faults causing most irritating delays down the Eastern routes. . . . I know that the Engineering Department are working as hard as they know how in order to keep down the incidence of these defects and to reduce the consequent irregularity. And I must also pay tribute to the way in which our flying staff, and also our ground staff down the routes, have kept the services running in spite of all the difficulties."

Answers to questions at the conference indicated that the Britannia 312 had been 10 per cent down on the lowest range performance guaranteed by the makers, though Bristol had so far recouped 3 per cent. As a result the aircraft "would be unable to operate regular non-stop transatlantic services" (a regularity percentage "in the sixties" was mentioned). Bristol "were not right" in saying that the range was not outside the tolerances. Mr. d'Erlanger would not, he said, object to a proposal for a joint meeting to be held to air the matter. He confirmed the existence of penalty clauses for delayed delivery which covered the Corporation "to some extent"; but he would not describe the nature of these penalties or whether they had yet been invoked. The 312 (the first two of which, when this issue appears, should have been delivered to B.O.A.C.) had not received a C. of A., but the aircraft would not be put into Atlantic service until B.O.A.C. were satisfied that the icing problems had been solved.

U.S. Army Evaluates Decca

TRIALS are being carried out in Germany with a Sikorsky H-34 helicopter fitted with a Decca Navigator Mk 8 and Flight Log. The installation was made at Croydon and the evaluation flights will be made from the American base at Schleissheim, near Munich. In the helicopter, the control boxes are located on the central console, the Deccometers on a slanted panel opposite the co-pilot. The Flight Log is mounted in the centre of the coaming structure. The aerial is housed in a dielectric box under the fuselage, level with the aft bulkhead of the cabin.

NAVIGATIONAL EVALUATION: The cockpit of the U.S. Army H-34 helicopter with Decca Navigator meters and Flight Log disposed on the left and centre panels. (See "U.S. Army Evaluates Decca.")

Helicopter Association's Dinner

THE annual dinner of the Helicopter Association of Great Britain is now firmly established as one of the major occasions of Farnborough week. This year, on the Tuesday evening, more members and guests assembled at London's Dorchester Hotel than ever before, and the gathering was honoured by the presence of Mr. Helicopter himself in the person of Igor Sikorsky, and by the Minister of Supply as guest of honour.

The absence through illness of the Association's president, Lord Brabazon, was much regretted, but Dr. G. S. Hislop, a vice-president, deputized most competently.

Welcoming the guests, and replying to the toast of "The Association" (which had been proposed by the Minister of Supply, Mr. Aubrey Jones), Dr. Hislop said that "helicopters must achieve the requisite operational costs to succeed commercially." Those services which operated successfully today were nevertheless dependent upon subsidies.

He next paid tribute to Mr. Norman Hill—a founder and mainstay of the Association—on his retirement, and went on to announce that the Alan Marsh award to help students to study helicopter engineering had this year been awarded to E. R. Kendall, of Saunders-Roe, who is already a student at Cranfield.

Dr. Hislop next remarked that, in order to implement the provisions of the Defence White Paper, helicopters would be needed by all three Services. He noted that the Army now had control of its own helicopters up to 4,000 lb in weight. Turning to the dismal picture of London's heliports, he pointed out that there was no longer a South Bank site, and no replacement was in view. It was a grave situation that while other far-sighted cities opened heliports, London closed them. We might have at least a platform on the Thames—why not let the Royal Engineers have a go at providing it?

"Flight" photograph

BREAK-UP of the Sea Hawk aerobatic formation of No. 738 Squadron, dramatically glimpsed from a Gannet of the composite anchor formation, on its run-in to Farnborough last Saturday. A "Flight" staff member who flew in one of the aircraft describes his experience below.

Replying for the guests, Mr. Eoin Mekie, chairman of British Aviation Services, said to the Minister, to accompanying laughter, "If I were a helicopter, I would have the ability to hover as you have done tonight." Unlike Mr. Aubrey Jones, who had the ability to fly where he wanted, the independent operators had no freedom to fly where they wanted. How different this was from shipping. National prestige, it seemed, demanded that freedom must be denied to the independents.

WITH THE GANNETS TO FARNBOROUGH

A FINE Sussex drizzle dampened our approach to the Royal Naval Air Station at Ford, near Littlehampton, on Saturday morning. Spirits revived, however, in the glow of Naval lunch-time hospitality. The official object of our visit was to fly in one of the Gannets taking part in the Navy's contribution to the S.B.A.C. Display at Farnborough.

We were also able to meet some of the officers of the new Ford unit (700X Flight) which was awaiting the arrival of the Vickers Supermarine Scimitars; and to congratulate Lt. Cdr. "Spiv" Leahy of 738 Squadron and Lt. T. P. Bourke of 801 on their superb Sea Hawk demonstrations. Members of the Sea Hawk formation team were interested (we choose this word carefully) in the illustrated publicity leaflet published by their R.A.F. rivals of 111 Squadron, a copy of which was the subject of much wardroom comment.

But our primary interest was to fly in a Gannet, a wish that was gratified with the help of 825 Squadron and the weather. It was still raining at Ford when briefing began just after 2 p.m., but the cloudbase had risen and forecast conditions were reasonable for Farnborough.

The twelve-Gannet formation comprised four from each of three squadrons, 796, 825 and 737. The flights were led by Lt-Cdrs. W. L. Hughes (formation leader), R. Leonard, and R. D. R. Hawksworth, and I was to accompany Lt. Donald Currie, starboard wingman of the 825 quartet. Only snag in the forecast was that moderate-to-severe turbulence was expected. Our scheduled time over the boundary at Farnborough was 3.21 p.m. Lt. Cdr. Hughes concluded the briefing: "——and no waving at Mum. It's TV day, so let's concentrate on the formations."

It transpired that concentration—and hard work—were needed by the Gannet pilots, for conditions were bumpy for most of the flight. Double Mambas were started at 2.35; wings were flexed and unfolded; and flaps checked by ground crewmen. From the apron in front of the hangars, where the two lines of Gannets faced each other like teams in some party game, we taxied out quickly and closely to the end of the runway. There I noticed a massive iron chain along each side of the runway—unusual, but then we *were* aboard H.M.S. *Peregrine*.

Take-off was at 2.50. Farnborough crowds would now be preparing for the flying display. Well, so were we. The formation joined up in a wide arc over the sea and headed back inland, crossing over Ford. Crawling out to the runway below us were the red ants that were the 738 Squadron Sea Hawks. The solo man had taken off just before us and, inverted, he now flashed past to starboard. The Gannets, too, were to shake-down with some practice *en route:* an R.T. call came from 31 Leader; "Form anchor—go." Port and starboard wingmen of the second flight moved out and forward and the formation settled in to its anchor shape.

Back in line astern (in flights) again, we circled the town of Alton. Below and to starboard was Lasham Gliding Centre, with unusually little activity for a Saturday afternoon—but then this was Farnborough Saturday. Gannet 347, our slot-man, was a close companion as I looked across from my rear cockpit. "Pilot's Mate, N/A. Phillips," I read on 347's fuselage. All three Gannet squadrons were wearing the red-and-white fin chequers of 825 for this occasion: how far could you go in straining the loyalty of 737 and 796, one wondered?

From Alton on to Odiham, our final holding-point. One circuit, and then a straight run in towards Farnborough, with the rear flight of Gannets shutting down one-half of their Double Mambas. Speed increased slightly as we lined up at 180 kt, 500ft. As forecast, the turbulence was moderate to severe.

Impressions were confused as we passed over the airfield. Hundreds of coaches, thousands of cars, the black mass of the crowds, the public grandstand, the blue-striped enclosures (the boys *there* were not being bumped around), the static aircraft park, and more cars. That was it, and there above us were the red Hawks going up and over in their first loop.

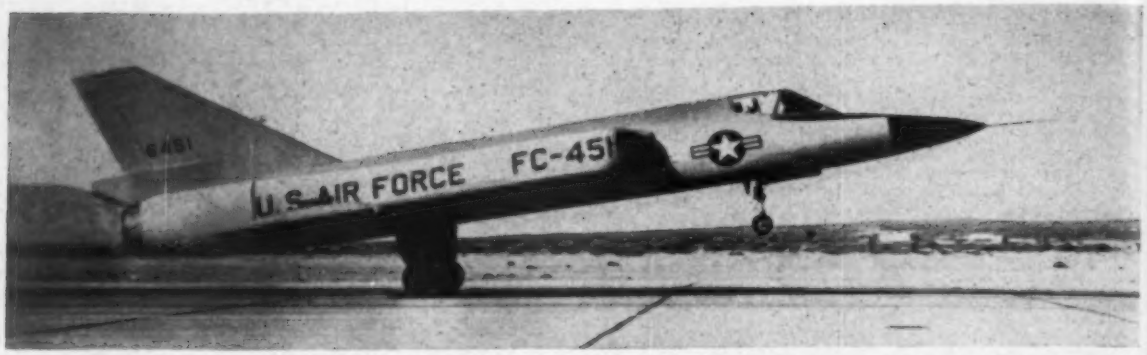
Re-formed in anchor, we came back for our second run, this time at 1,500ft. As we approached, the Hawks' smoke trails twisted down from their final bomb-burst—a splendid sight—and one of them shot across beneath us. Over the airfield we could see only the opposite side this time, with a big white Vulcan standing out among the parked machines.

This, then, had been our Farnborough Saturday, our brief moment in the limelight. A bumpy ride, involving hard work for the pilots. A bumpy ride, threatening (but mercifully not accomplishing) the return of your correspondent's wardroom lunch in Gannet 346. We circled Littlehampton, ran in across Ford airfield and peeled off to land. Our flight had lasted 50 minutes. We rolled to the end of the runway and turned on to the perimeter track. There were chains at *this* end of the runway, too.

K. T. O.

FORTHCOMING EVENTS

Sept. 9-15. Battle of Britain Week.
Sept. 13. Royal Aeronautical Society: 45th Wilbur Wright Lecture: "Advanced Education and Academic Research in Aeronautics," by Dr. Clark B. Millikan, Hon. F.I.A.S., F.R.Ae.S.
Sept. 14-15. Popular Flying Association: Rally, Sywell.
Sept. 14. Lancashire Aero Club: Dance.
Sept. 15. North London Aero Club: Competition Day, Panshanger.
Sept. 15. R.Ae.S. Garden Party, Wisley.
Sept. 16-20. Institute of Metals: 49th Annual Autumn Meeting.
Sept. 18. Technological University, Delft: Second Dr. Albert Plesman Memorial Lecture: "The Oceans of the Air; Some of the Aspects of Future Turbine Flight," by A. E. Raymond, Douglas Aircraft Co.
Sept. 19-22. Austrian Aero Club: Innsbruck and Salzburg International Air Rally, Innsbruck.
Sept. 21. R.N.A.S. Abbotsinch, Paisley: At Home.
Sept. 21-22. Cranfield Society: A.G.M. and Dinner, Cranfield.
Sept. 24-26. Royal Radar Establishment: International Symposium on Electronic Components, R.R.E., Malvern.



DELTA DART is the name conferred on the new Convair F-106A all-weather intercepter, of which this is one of the first pictures released. The fuselage is over 70ft long, and the turbojet is a Pratt and Whitney J75 with reheat.

HERE AND THERE

Expendable Furies

ABOUT 30 Sea Furies formerly operated by the Dutch Navy are now for sale, having been replaced by Sea Hawks.

Dutch Air Strength

IT was stated recently that the Royal Dutch Air Force now has over 20,000 personnel, ten up-to-date bases and "several hundred modern jet fighters."

Boeing Estate

THE estate of the late Mr. William Boeing, founder of the Boeing Airplane Co., who died last September at the age of 74, has been valued in Seattle at £7,995,000. Taxes amount to £3,200,000.

Communist Air Exercise

JOINT air exercises over the East German city of Cottbus were carried out early this month by East German, Soviet, Czech and Polish military aircraft, according to an East German broadcast.

Five-year Cruise?

A CONTRACT has been tentatively awarded by the U.S. Navy to the Newport News, Va, Shipbuilding and Drydock Co. for the construction of an atomic-powered aircraft carrier of 80,000 tons, costing over £107m. It was revealed earlier this year that the ship—1,088ft long—would be powered by eight reactors, containing enough nuclear material to supply motive power for five years without refuelling.

HAROLD GATTY, whose death we recorded last week: a recent photograph taken by Walter Bird before the famous navigator set off for Fiji, where he died. Only a short while before Gatty had completed a new book called "Nature is Your Guide," dealing with his flying experiences.

"Flight" photograph

Another Missile Regiment

A SECOND Army regiment equipped with Corporals is being formed, with the conversion at Oswestry of No. 27 H.A.A. Regt. —recently repatriated from Hong Kong— into No. 27 Guided Weapons Regt. The formation of the first G.W. regiment—No. 47—was announced in February.

Doubled Up

IN Cairo recently the War Minister, Maj-Gen. Abdel Hakin Amer, said that the Egyptian Air Force had doubled its strength since last November. He told the National Assembly that during the Suez hostilities E.A.F. aircraft had been removed to airfields in West Egypt and Saudi Arabia.

Long-range Forecaster

AT the Central Forecasting Office, Dunstable, recently, Mr. W. J. Tomkins was presented with a fountain pen subscribed for by colleagues to mark his completion of 55 years' service in the Meteorological Office. Mr. Tomkins, who is 69 and started as a boy of 14½, is continuing to serve on the Dunstable staff.

Alpine Ballooning

AN attempt to fly by balloon from Switzerland to Italy over the Alps for the first time since 1910 failed early this month when the *Zurich*, captained by M. Fred Dolder, landed three miles north of the Italian frontier, after being in the air over five hours. Also aboard were two members of the second Swiss Everest expedition, MM. J. Marmet and A. Reist, who took photographs and made observations on high-altitude physiology.

Gloucester Encouragement

SPEAKING in Gloucester last week, the Joint Parliamentary Secretary to the M.T.C.A., Mr. Airey Neave, said that no grounds for despondency or alarm existed in the aircraft industry; on the contrary, he saw great opportunities ahead for it. The Government had already done a good deal to help Gloster Aircraft and Armstrong Siddeley—the only two aviation companies in the Gloucester area likely to be affected by redundancy—and it would continue to do all it could.

HARRIER is Hunting Percival's name for this lightweight folding general-purpose vehicle, suitable for carrying in the Pembroke. It weighs 6¼ cwt, and when folded occupies a mere 33 cu ft. (The Harrier is seen making a very low pass at Farnborough.)

POINT OF DEPARTURE

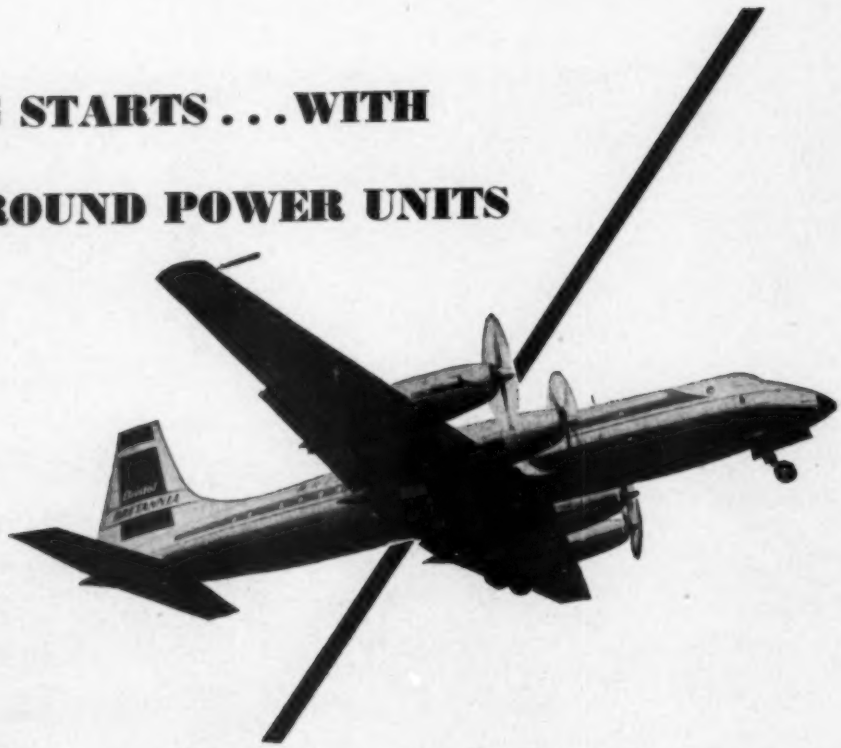
...across Europe in a B.E.A. Viscount with

ROTOL PROPELLERS & EQUIPMENT

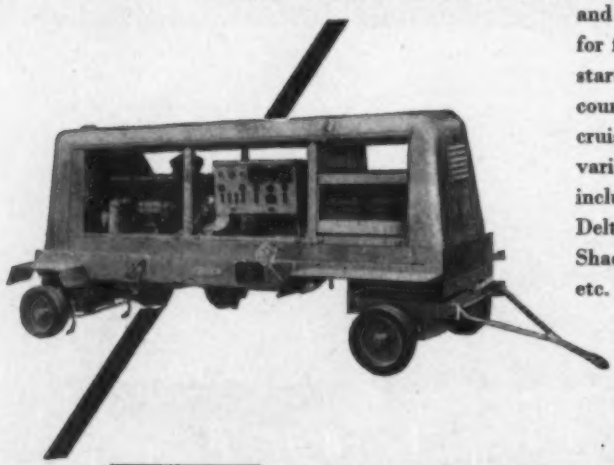
ROTOL LIMITED · GLOUCESTER · ENGLAND

PUB/R/47/57

FLYING STARTS . . . WITH MUREX GROUND POWER UNITS

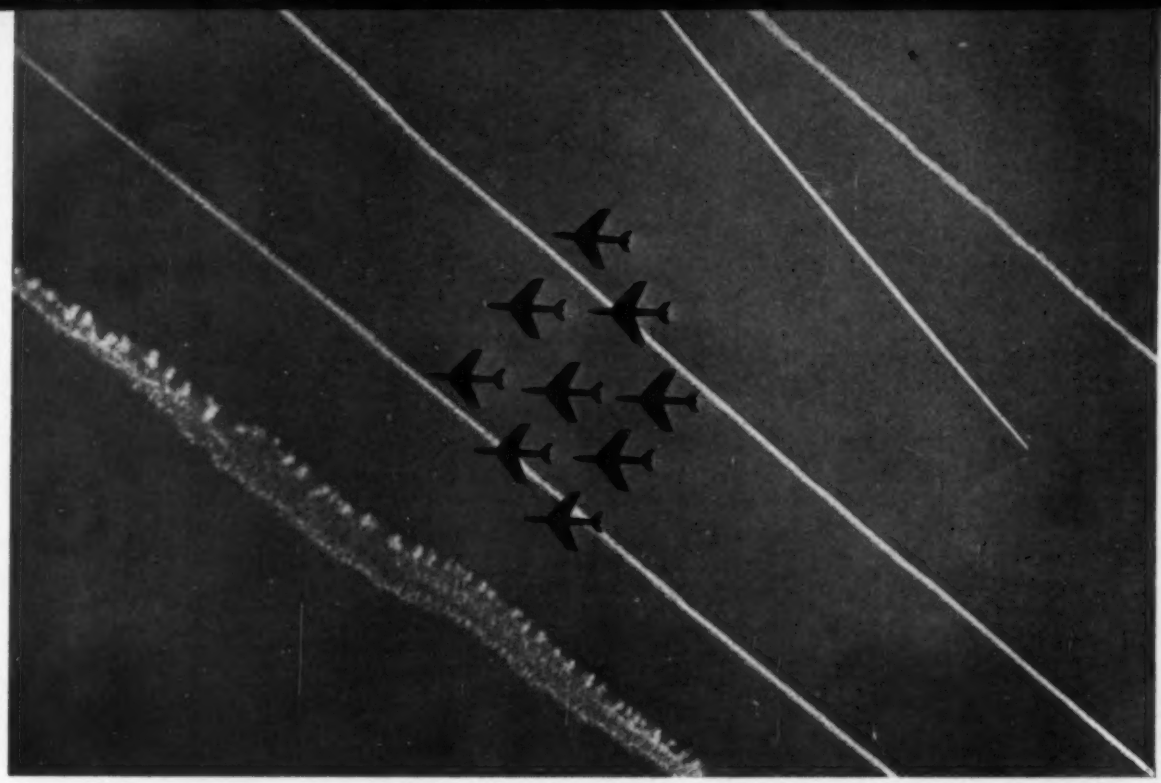


Many of the world's most famous aircraft such as the Bristol "Britannia" are started and serviced by Murex Ground Power Units. These engine driven units have been designed to supply electrical current for servicing all types of piston, turbo-jet and turbo-prop aircraft and they are used by leading operators and manufacturers throughout the world. Special models can be supplied to meet individual requirements, but standard models are designed for a peak load of 2,000 amperes for engine starting periods and to provide a current of 600 amperes continuously at 28 volts for servicing and pre-flight checks. Please write for full details. Famous civil aircraft started include the Britannia, Viscount, Comet, Elizabethan, Stratocruiser, Constellation, Douglas and various helicopters. Military types include Vulcan, Canberra, Fairey Delta 2, Meteor, Vampire, Venom, Shackleton and Jet Provost trainer, etc.



MUREX AIRCRAFT GROUND POWER UNITS

MUREX WELDING PROCESSES LTD., Waltham Cross, Herts. *Tel.:* Waltham Cross 3636



FARNBOROUGH WEEK

THE INDUSTRY'S PROUD PRESENTATION

ILLUSTRATED MAINLY WITH "FLIGHT" PHOTOGRAPHS

THAT Farnborough week came fully up to expectations—at least so far as the flying was concerned—is evidenced by the day-to-day descriptions which follow. Only on two afternoons, a liquid Wednesday and preponderantly damp Friday, was the programme seriously hampered by weather; but on both occasions the ability and care of pilots and flying control saw to it that the watching thousands were not deprived of entertainment. On the really good days, Thursday and Saturday especially, the brilliance and variety of flying—with exceptionally strong Service participation, from both R.A.F. and Royal Navy—gave this S.B.A.C. Show almost the character of a national air pageant, rather than of an industry's exhibition.

Vivid impressions etched themselves on the eye and mind: the black Hunters of Treble One changing their pattern against the sky; scarlet Sea Hawks with their smoke plumes; the Scorpion-Canberra sailing heavenward as if drawn by an invisible wire; the uninhibited double act of Miles Student and HDM.105. Such memories, and many more, will long remain—at least until the next Farnborough produces fresh delights.

Statistically, too, the Show was a success. The "gate" on Sunday has been estimated as 107,000 (including people in cars); when fully worked out it may rival the bumper year 1953. On Saturday there were 75,000 people, plus 5,000 cars (an attendance of approximately 85,000, reckoning two to a car); on Friday, 17,500 pedestrians and 4,000 cars. There was a new record for overseas V.I.P.s, 7,000 attending. On each of the private days there were between 5,000 and 6,500 cars. All these figures are, of course, subject (in F.A.I. terminology) to homologation; but they serve to show how well the 18th S.B.A.C. Show was supported.

In the detailed accounts which follow, the public days are described first.

Friday. On this, first of the public days, some 17,500 people (with an additional 4,000 cars) came to Farnborough. They saw a flying display which, by reason of the pilots' skill and the ability of ground control, overcame very unfavourable weather conditions. Three of the Hunters on view—the Two-Seater, the F.4 with Fireflash and F.6 with rockets—had to do radar-controlled circuits. At times a kind of sea-mist blew in from Laffan's Plain, and at no time during the afternoon was the cloud-base much above 1,000ft.

Thus there was some curtailment of the programme—the SR.53, for example, did not appear; nor did the B.1 Vulcan—but there was still plenty to give great enjoyment. Both Morgan in the Scimitar and Elliot in the Sea Vixen, their aircraft impressively wreathed in shock-waves and condensation, seemed unperturbed by low cloud and poor visibility; and although Beamont in the P.1B was probably below Mach 0.98 on his fast run there was nothing below par about the rest of his demonstration.

The helicopters, as partakers of the lower air, were not much troubled by deteriorating skies; and the Sycamore, the Ultra-Lights, the Skeeters and the assorted Westland types put on their entertaining shows with undiminished verve. So did the four Whirlwinds of No. 705 Sqn., F.A.A., making a first appearance at Farnborough. Their zestfully executed square dance, accompanied by appropriate music and commentary, drew applause from the enclosures.

Saturday was a day such as display organizers experience in

(Continued on page 432, after double page of pictures)

There can have been no prouder man at Farnborough than our Chief of the Air Staff—for reasons exemplified by our heading picture of the black Hunters of 111 Squadron, Fighter Command, seen against the contrails of Bomber Command Valiants and Canberras. Evidently Col. J. de Loustal, the French Air Attaché, was not unimpressed.

V-bombers in all their majesty—the Victor B.1 coming in over the Vulcan B.2.

FARNBOROUGH WEEK . . .

Astonishing shock-wave formations are visible here on the Firestreak-Hunter.

One of the most awesome and inspiring spectacles ever witnessed—the salute of R.A.F. Bomber Command.

Portrait of a British airliner: the Aviation Traders (Engineering) Accountant.

FARNBOROUGH WEEK . . .

their happier dreams. There was about three-eighths low cloud when Oliver Stewart made his first announcement, but by the time the Navy's red Sea Hawks made their appearance a fresh breeze had swept away such cloudy cobwebs, and for the rest of the afternoon there was a perfect aerobatic backcloth of high cirrus and blue sky.

What can be singled out among so much that was excellent? Bill Bedford and his "skiffle group" (as Oliver Stewart called them)—Lockspeiser, Bullen, Merewether and Simpson—seemed doubly brilliant, as if to make up for their weather-curtailed show on Friday; McIntosh (staunchly paired by Forbes in the HDM.105) must surely have sold a hundred Students, had he been performing before potential buyers, so dashing was his demonstration; Tennant in the Gnat and later Beamont in the mighty P.1B seemed to be vying with one another as to which could pull the greatest amount of g in high-speed turns (Bea's application of reheat came through as a muffled bang after he had climbed away from his fast run); the nine Hunters from Treble One Squadron, and later the five with their bomb-burst and departing rolls were never less than superb; nor were "The Sparrows" from Little Rissington outshone in their piston-engined Provosts, which had a certain slow-motion charm by comparison with so many super-speed performers.

In all, it was a most successful day, with something for everyone. To at least one spectator's mind, the four Westland helicopters nearly stole the show. With their antics right in front of the audience, these agile machines are surely the real successors of the barnstorming days of the 1920s and early 1930s, when the "circuses" disported in local fields.

Sunday. By mid-day it was quite astonishingly warm for September, with splendid conditions for the flying display apart from a cross-wind (though not a strong one) at about 70 deg to the main runway. The weather was cloudily picturesque, with plenty of cumulus for the aircraft to perform against, though too much to allow the high-flying Valiants and Canberras of Bomber Command to be seen. It affected the programme in only one respect, in that when the black diamond of No. 111 Squadron appeared and went up into what is customarily a loop, these brilliant Hunter pilots rolled instead, to avoid going into a heavy cloud. This ninefold roll was a virtuoso performance even by 111's astonishing standards. Though there were one or two showers during the flying, conditions stayed good until the end, when the SR.53 had to perform and land in heavy rain. This abrupt shower was a disaster for many of the 107,000 spectators (a first-estimate total likely to be increased when final takings are known), for most of them must have got well and truly soaked on the way to catch homebound buses and trains.

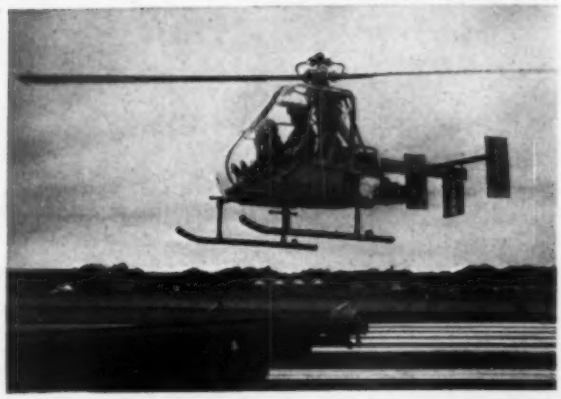
However, they could at least leave the 18th S.B.A.C. Show with satisfying memories. Perhaps the most dramatic was of Tom Lampitt in the Scorpion Canberra, taking off from the west end of the runway and rocketing vertically into a tremendous climb topped by an upward roll. His second climb and upward roll following a fast run were hardly less sensational, executed with all the skill learned in Fighter Command Aerobatic Team days. Not a whit less skilful was the beautiful handling of the Gnat by S/L. Das, whose performance was a masterpiece of precise judgment. Like Beamont's in the P.1B, every move was carefully designed to show off the aircraft's appearance and abilities within easy view of its audience. Similarly the two Vulcans, Mks. 1 and 2, were demonstrated to the best possible effect, their differing shapes shown off excellently against the cloud background by Harrison and Falk; and Harrison's landing run (without the use of a braking parachute) was amazingly short.

Again the four Hunters under impresario Bill Bedford put on a magnificent show of speed and manœuvrability (seemingly unaffected by varied under-wing stores); the R.A.F. display, rounded off with two white Christmas Island Valiants and two white Vulcans in tight formation, was indeed (as Oliver Stewart put it) "something to remember"; so was the Royal Navy's skilled and varied contribution, with the Whirlwinds of No. 705 Sqn. performing their square dance in a circle of 30yd radius with their rotor blades only 10ft apart; so were individual performances like Geoff Worrall's impeccable aerobatics in the Javelin and his beautifully judged steep approach. In all, this was a splendid finale to Farnborough 1957, crowning an S.B.A.C. Show which ranks among the best ever witnessed.

(*Flying on the trade days: page 433*)

NEW ANGLES ON THE SHOW

This year, in addition to *Flight's* normal coverage of the Show, yielding the descriptive material in this issue, we looked at it from three new angles. A staff writer sat down at several of the stands in the big tent and simply watched what happened there; he visited the display pilots' tent near the control tower; and he flew (see page 427) as a passenger with one of the Naval formations.



The Fairey Ultra-Light returns to its lorry home after a jolly romp.

There are (he writes) advantages and disadvantages in being a company representative on an exhibition stand at the S.B.A.C. Show. It is pleasant to have a sense of power—people are looking at *you*, and *you* are the one who decides whether they receive an ordinary leaflet, a glossy brochure, a folder to carry all the other companies' literature, or nothing at all. On the other hand, there are the horrors—both abstract and human—of the public days. ("Those ruddy small boys are the end. Honestly, I turned my back once last year and they'd taken everything—including the message pad.")

The immediate sales value of contacts made at the show obviously varies from company to company, and is perhaps greatest for the smaller exhibitors. Presumably few visitors are going to order expensive aircraft or engines simply because they see a model on a stand, are told how good the thing is going to be, or are entertained to an excellent lunch.

The visitors, then, include few who are likely to draw out cheque-books and order expensive aeroplanes. Instead, they include many who want technical information, many who are making purely social calls, and a number of high-level people from other companies who combine both these aims. The man on the stand has to steer them, as appropriate, to technical expert, company head, or both.

The foreign Press and the flying display can cause their own difficulties. And when the language barrier and the noise of P.1s and Hunters combine, the effect is nerve-shattering. All one can do is smile politely, light a shaking cigarette, make a note of the inquirer's name and address, and think forward to that confidence-restoring Scotch after the display.

* * *

On the north side of the runway, near the control tower, is the display pilots' tent. Here the pilots' briefing is held, normally at noon each day. On Friday, first of the public days, the forecast weather was bad and two briefings took place, at 12.30 and 2.30.

At the latter briefing, G/C. D. C. McKinley, head of the flying control committee, announced that the programme would start as a "bad-weather routine" in which limited demonstrations were to be flown under V.M.C. A decision on the Service formations would be made later, and it might be necessary later for radar circuits to be employed.

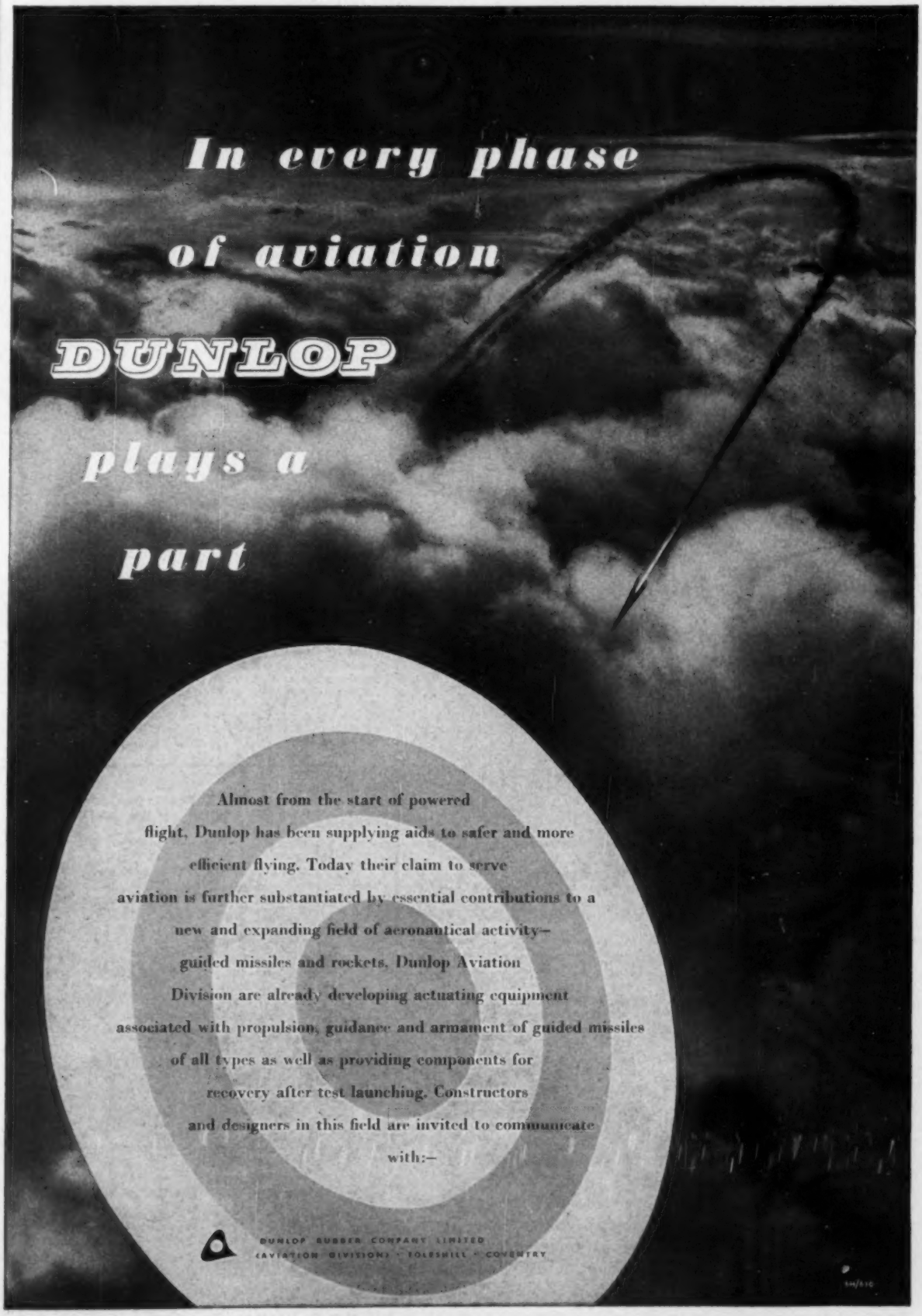
His audience had included the well-known faces of Britain's best test-pilots, plus a uniformed and bearded group whose task, incongruously, was to square-dance a quartet of sizeable helicopters. The industry pilots had the routine well buttoned-up by this time, and the briefing meeting was short.

Those pilots early on the programme left the tent and walked or drove to their aircraft. From the tent entrance the remainder regarded the drizzle and the low visibility without enthusiasm. "How are you today?" "I'd feel fitter if I could see that horizon a bit better. One's internal barometer goes up and down, too."

The enclosure in front of the pilots' tent is an extremely noisy place from which to watch the flying. None the less, each take-off, demonstration and landing is watched very closely indeed. On the other side of the runway sprawls the tented, crowded public site, but this is merely a background blur. Eyes are on the aircraft; and thoughts, most probably, are in with the pilot.

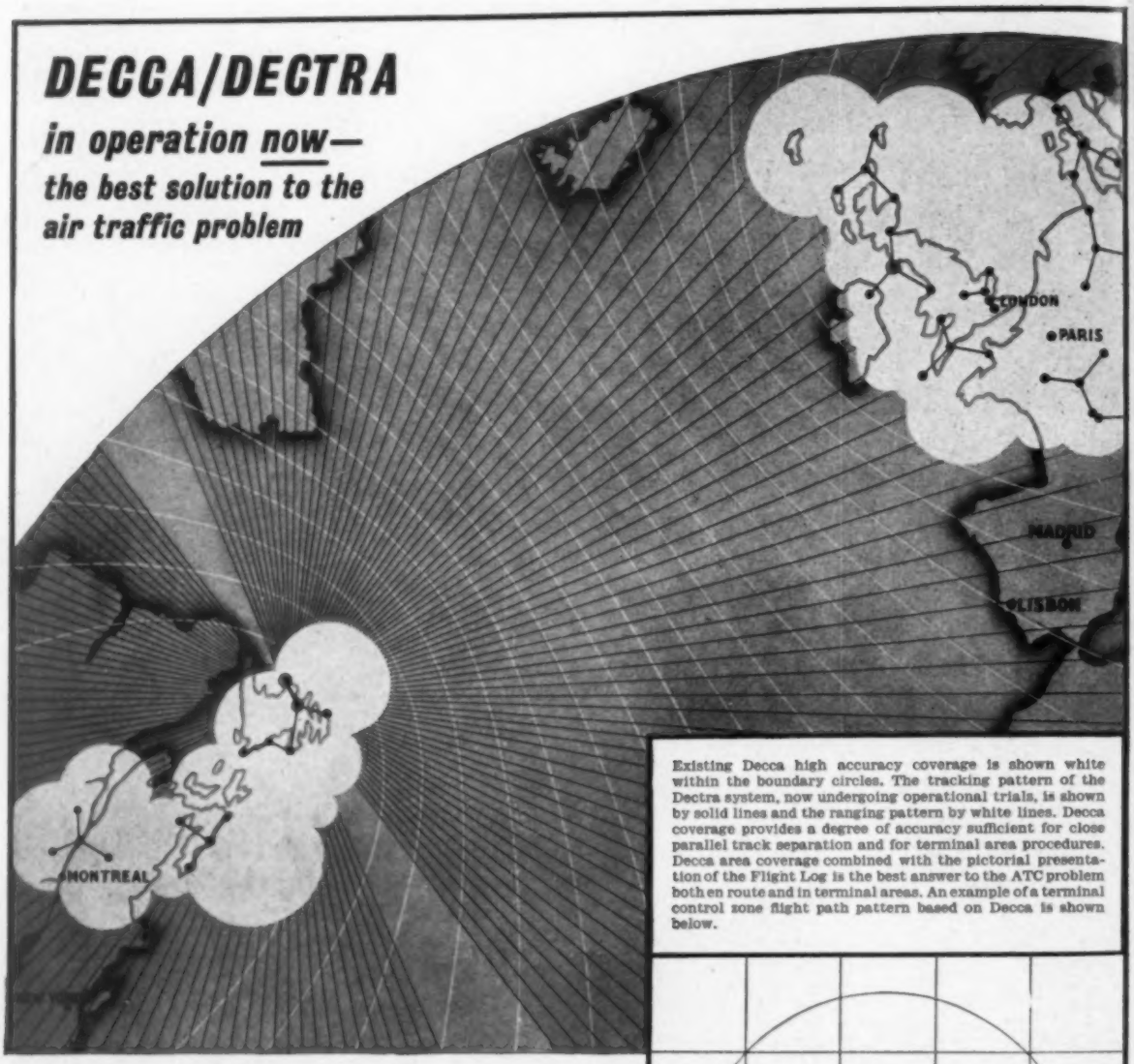
When the four Westland helicopters take their bow and move off towards us and the tower, we realize what the previously half-felt resemblance is. It is to a stage performance, which we are watching from the wings. The helicopters come offstage like a row of chorus girls (of a peculiar shape, granted). The illusion is carried further as other acts leave the runway stage at our end: the buzzing Harrier, coaxed up by the Pembroke; and the Fairey lorry driving past, with an Ultra-Light on its back.

One finds it difficult to notice as pilots slip away, and others

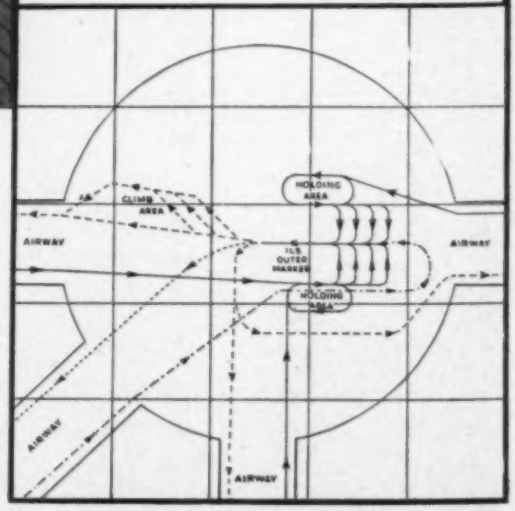

In every phase
of aviation
DUNLOP
plays a
part
Almost from the start of powered flight, Dunlop has been supplying aids to safer and more efficient flying. Today their claim to serve aviation is further substantiated by essential contributions to a new and expanding field of aeronautical activity— guided missiles and rockets. Dunlop Aviation Division are already developing actuating equipment associated with propulsion, guidance and armament of guided missiles of all types as well as providing components for recovery after test launching. Constructors and designers in this field are invited to communicate with:—
DUNLOP RUBBER COMPANY LIMITED
(AVIATION DIVISION) • TOLESHILL • COVENTRY

DECCA/DECTRA

in operation now—
the best solution to the air traffic problem



Existing Decca high accuracy coverage is shown white within the boundary circles. The tracking pattern of the Dectra system, now undergoing operational trials, is shown by solid lines and the ranging pattern by white lines. Decca coverage provides a degree of accuracy sufficient for close parallel track separation and for terminal area procedures. Decca area coverage combined with the pictorial presentation of the Flight Log is the best answer to the ATC problem both en route and in terminal areas. An example of a terminal control zone flight path pattern based on Decca is shown below.



Precise control of air and sea traffic can be accomplished today by the use of Decca/Dectra the proven high accuracy area coverage system.

DECCA/DECTRA is the only navigation system providing high accuracy local coverage at any altitude with medium and long range parallel track facilities using the same airborne equipment.

DECCA/DECTRA is the only system which provides pictorial presentation.

DECCA/DECTRA is the most economical system in the world both in cost and in use of frequencies.

The report of the Jet Operations Requirements Panel of ICAO meeting in Montreal in June 1957 has this to say:

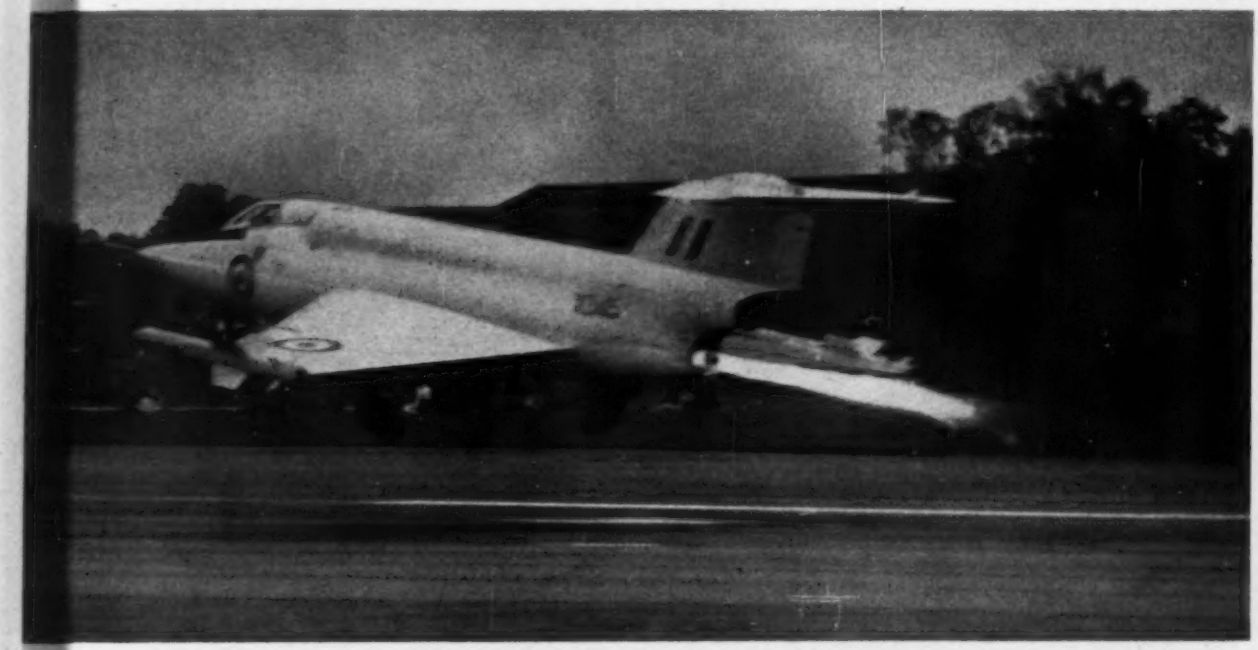
"The Panel recommends the adoption of an accurate and reliable short-range navigational aid based on the area coverage system and designed to provide pictorial presentation to the pilot in the cockpit. The Panel further recommends that the Sixth Session of Communications Division should consider this recommendation as a matter of urgency."

Over 4,000 ships and aircraft are fitted with the Decca System which has been in operation for over 11 years.

DECCA/DECTRA

the world's most accurate navigation system

The Decca Navigator Company Ltd London



With fiendish din and searing flame the Firestreak-armed SR.53 mixed-power intercepter (D.H. Spectre plus A.S. Viper) gets off.

FARNBOROUGH WEEK . . .

return after their displays. A few wives and families are here, watching. The noise of the low runs by the fast aircraft is deafening at this close range. A particularly spectacular pass by the Scimitar draws smiles and nods—but nothing to approach Dave Morgan's wide grin as he comes back to the tent a little later. We suddenly realize that the pilots, as well as the spectators, can enjoy the S.B.A.C. flying display.

THE TRADE DAYS

Visitors travelling to Farnborough by the Hog's Back route on **Tuesday** found themselves driving through almost continuous damp stratus between Guildford and Farnham. The morning at Farnborough continued moist, but interest in the aircraft and other exhibits was dampened not at all. Raincoats, umbrellas and the cute, fitted plastic bags worn to protect the hats of U.S. officers were all in evidence.

The forecast was that the low cloud would clear and the rain would ease off; and in fact the day did begin to dry itself out shortly before noon. Cameras clicked even more frequently: a Naval Whirlwind flew along the runway and was promptly ciné-filmed by a cigar-smoking company executive.

The helicopter alighted near the S.B.A.C. President's tent, and Lord Mountbatten, Lord Selkirk, and Vice-Admiral Ericson of the Swedish Navy stepped out. Other guests today included Government representatives George Ward, Aubrey Jones, Harold Watkinson and Sir David Eccles; the Third and Fifth Sea Lords, Vice-Admirals Sir Peter Reid and A.N.C. Bingley; Air Chief Marshal Sir Dermot Boyle, Chief of the Air Staff; and Gen. C. V. R. Schuyler, Chief of Staff, U.S. Army, and a contingent of officers from SHAPE.

Cloudbase had risen to between 1,000 and 2,000ft by 2.30 p.m., when the flying display began. The helicopter circus included two Fairey Ultra-Lights, the red-and-yellow G-AOUJ having joined G-AOUK to give a darting, chattering double-act which included the familiar yet still frightening autorotative descent caught at what seems only inches from the ground.

The scarlet Sea Hawk quintet from the fighter school at Lossiemouth (738 Sqn.) was hampered by weather, the team's opening loop taking them up into the low cloud and out of sight. Led by Lt-Cdr. "Spiv" Leahy, the Hawk formation gave an elegant display. They had not the fastest, nor the newest, aircraft—but, formation and solo man alike, there could be no smoother flying. A close formation landing completed their display.

Take-offs were being made today downwind, along main runway 25, in spite of which the Twin Pioneer's STOL characteristics were again well emphasized. Of the two remaining formation teams, the C.F.S. Provosts were a joy of precision to watch, while the incomparable Hunters of 111 Squadron performed their own formation-change card tricks, variously nine and five in number, with a polish which left the impression that S/L. Topp, their leader, had plenty (as opposed to nothing) up his sleeve.

First to take advantage of the cloud break-up was Rumbelow in the Jet Provost, who followed a particularly brisk show by Duncan McIntosh in the Miles Student. The day's only major unscheduled incident occurred as Bedford was making his take-off run in the Hunter Two-Seater. Well down the runway, and just becoming airborne, the machine was seen to lose its cockpit canopy, which blew back and appeared to hit the fin before falling back on the runway. Bedford continued the take-off, made a circuit and landed the Hunter without further mishap.

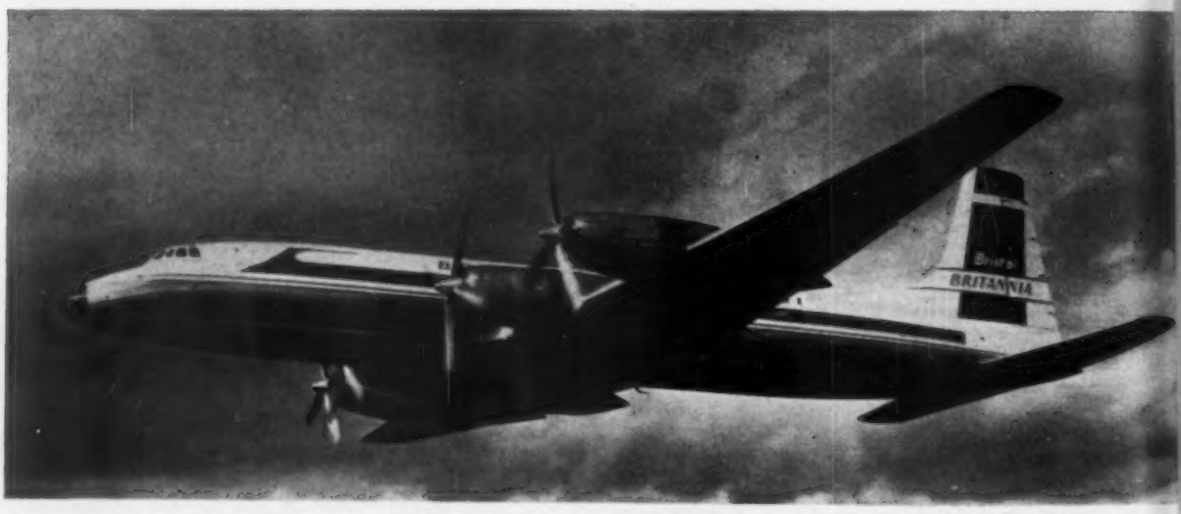
The afternoon's weather conditions were such that spectators gently baked under a warm sun while watching the impressive vapour-fringed passes by the Hunter 6s, Scimitar (flown by Lithgow) and Sea Vixen. Near the end of the programme came the first public performance of the Avon-powered English Electric

(Continued on page 436, after double page of pictures)

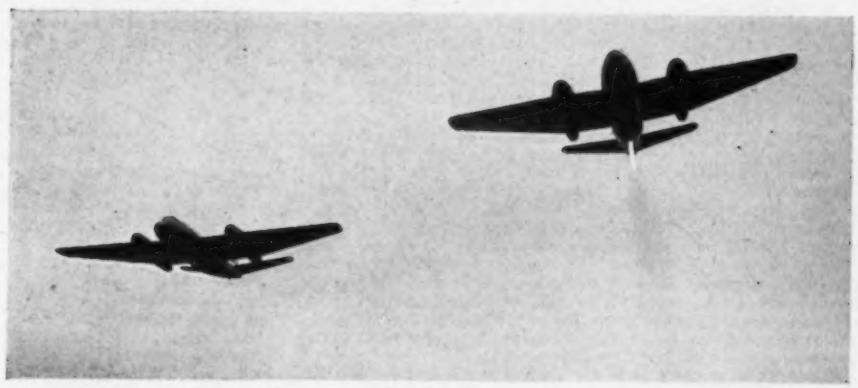
Distinctive patterns in the Farnborough sky: (l. to r.) the English Electric P.1A, with experimentally modified wing; the Vickers-Supermarine Scimitar, with four auxiliary tanks; and the record-breaking Napier/English Electric Scorpion-Canberra, with its belly-mounted Double Scorpion running "cold."

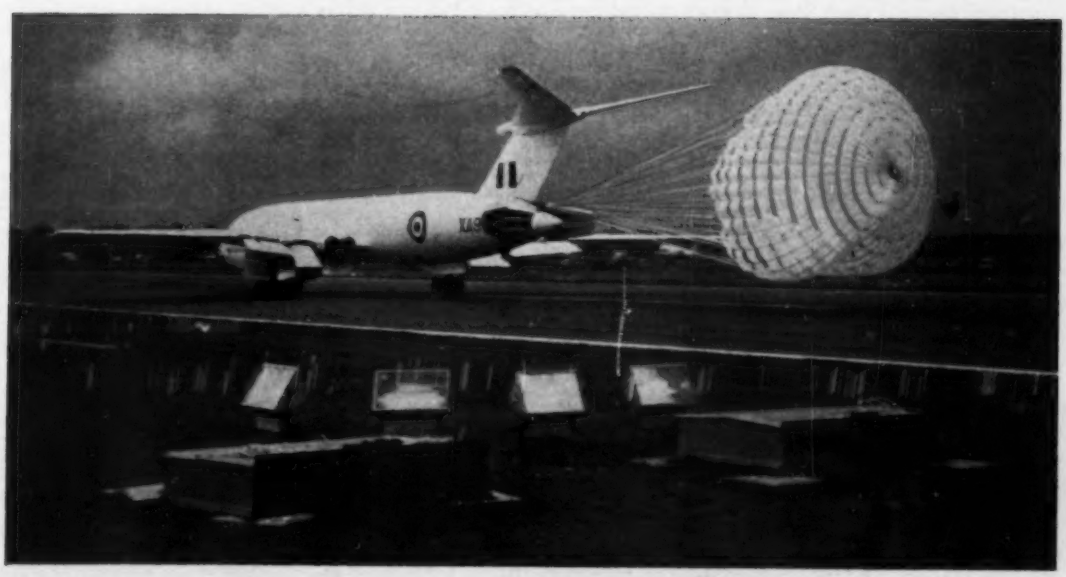
FARNBOROUGH WEEK . . .

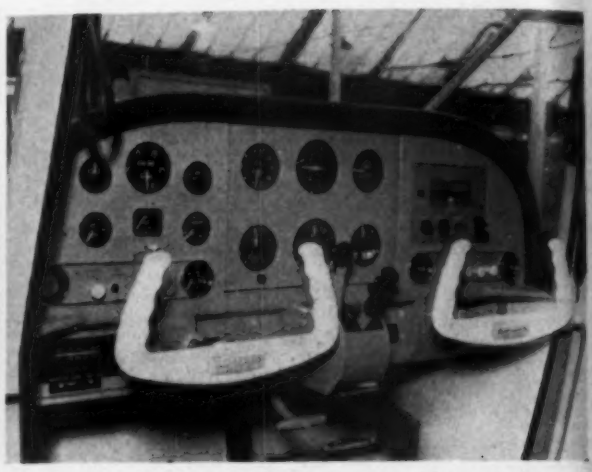
Above, silhouetted against their own smoke trails, are the crimson Sea Hawks of No. 738 Squadron; then an intimate portrait of the Herald. Below, in stately passage, is the Britannia 301, and finally (in not-so-stately passage) the rollicking Naval Whirlwind square-dancers.



The picture above gives a particularly pleasing impression of the Conway-Vulcan's low pass. On the right, de Havilland's two Canberra test-beds (Gyron Junior turbojet, left, Spectre rocket right) go into their act. Last, the Victor demonstrates its magnificent new braking 'chute.







Exterior and interior of the Auster Atlantic Windsor de Luxe. It will be seen that the cockpit has been styled in motor-car fashion.

FARNBOROUGH WEEK . .

P.1B flown in characteristic fashion by Roland Beamont. The P.1Bea combination, apparently g-proof yet minus g-suit, proved to be fully as impressive as we had expected.

Other differences in today's flying display included the substitution of a Javelin 4 in place of the Javelin 7; and the first fly-past appearance of the Orion Britannia.

Wednesday morning, damp and grey to begin with, lost little time in becoming very wet indeed. Visitors included Lord Mancroft, Admiral Sir Charles Lamb (Second Sea Lord), Sir Richard Powell and the Prince of Morocco. Farnborough lay immersed in a steady drizzle: the parked aircraft were scrutinized and photographed more rapidly; once beneath the shelter of the exhibition big top most visitors were tempted to stay there; and the convivial guffaws and background talk floated up at an earlier hour from the caravans and enclosures. Motorists edging queue by queue past the Queen's Hotel looked enviously at the Decca-chartered B.E.A. Whirlwind landing with its fortunate few on the parade ground opposite.

With steady rain, a cloudbase of 700ft, and the far side of the airfield blurred in a light-grey wash of mist, the limited flying display began at 2.30 p.m. The Navy and R.A.F. formations, obviously, could not appear; and the majority of the individual aircraft displayed were to fly in radar-controlled circuits. Most displays were confined to single low runs along the runway—with the exception of the helicopters, all of which were able to ignore the weather and carry out their full routine.

After the helicopters came the Twin Pioneer and the H.D.M. 105, and then in turn the Gannet 5; the five Canberras, variously powered; Comet 3, Herald, Pembroke and Accountant; and the four Hunter 6s (one of which, flown by Hugh Merewether, caused many pilot spectators to gasp during a roll which swerved uncomfortably close to the ground). Scimitar and Sea Vixen made fast low runs, followed by the Victor and an exhilarating vapour-crested fast approach by Bedford in the replacement Hunter Trainer, the red-and-white XJ 615. Last two machines to fly were the P.1A and the reverse-thrust Hunter.

To put on any flying display at all in such foul weather had been no mean achievement. Pilots and controllers had done well.

Thursday, it seemed that morning, was more of a "real" day. Blue sky and cumulus cloud-streaks at noon made one or two visiting glider pilots (including the British National champion) think of diverting the S.B.A.C. show and heading for Lasham, but the attraction of the noisy, powered brutes—and the restrictions on non-display flying in the Farnborough-Lasham area—triumphed. Just how splendid a day it was to be was made clear in spectacular fashion that afternoon.

In the aircraft park, cameras and more cameras were clicking everywhere—how many miles of film, one wonders, does the S.B.A.C. show absorb each year? A scorched gun-port beneath the belly of Hunter Two-Seater XJ615 proclaimed the gun-firing trials which the machine had been carrying out at Boscombe Down before being called on to understudy and deputize for XJ627 at Farnborough. There were now two small-and-yellow Fairey Ultra-Lights in attendance, G-AOUK having been repainted yellow on Wednesday night.

The flying display began with the promise of good things. Under a warm sun the Gannet 5 barrel-rolled and shut down half of its Double Mamba, and the Canberra quintet introduced with a roar the dash and liveliness that had been missing from the previous day's display. The Conway Vulcan banked across, sunlight and cloud-shadow flickering on its wide, white delta span.

This was real display weather. Against the blue sky and white cumulus, the glossy red Sea Hawks again excelled. Lt. Bourke of 801 Squadron, the solo man, again delighted with the smoothest slow rolls, the prettiest loop.

After civil transports, it was the turn of the R.A.F., and today there was something splendidly new as a background to the formations. Approaching high from the east were the contrails of the first dozen or more of over 90 Valiants and Canberras of Bomber Command which, flying at 35,000ft, were using Farnborough as a "target for operational exercises." While the C.F.S. Provosts manœuvred with precision; while the Javelins' noise was felt in our stomachs; and while the glistening black fish, roundel-eyed, that were the incomparable Hunters of 111, swam in rock-steady shoal around the lower sky, the high trails formed a fantastic backdrop. To the east, a tangle of thin white threads; above and to the west, a strong sunlit pattern of bold, white brush strokes on a glaring blue canvas.

This was display spectacle unsurpassed for many years. It is much to the credit of the remaining pilots and aircraft that no sense of anti-climax followed.

Among the later items, the variously loaded Hunters were able to give their co-ordinated act full rein, beginning with a fast low pass by the Two-Seater, once more wearing its characteristic vapour cap on top of its cockpit canopy. The Vulcan B.2 made a noticeably short landing; Beamont again screwed the P.1B tightly around the sky; and the needle-nosed F.D.2 banged its afterburner on and made its climbing rolls with decision and emphasis.

Variety, speed and spectacle had been the keynotes of the afternoon's flying, from the first Gannet to the diamond-studded take-off flame of the SR.53, last on the programme. Among those lucky enough to be present were Lord Mills, Minister of Power; the South African Minister of Defence, and the Sheikh of Bahrain. To round off the afternoon, the red Sea Hawks of 738 Squadron huddled together and made off down the runway, like a gang of boys heading out for more mischief.

Seen in its Service dress is the Military Twin Pioneer. Still bearing development markings is the pre-production Hunting Percival Jet Provost T.3.

On the Polar route to Australia

When, in the not-too-distant future, aircraft will be flying at stratospheric heights, they will be routed to the Antipodes 200,000 ft. above and across the white-out of the Greenland ice-cap.

The dramatic scene shown above is as accurate a pre-supposition of visual conditions on such a flight as present knowledge permits. Beams of very high-energy-charged particles from the sun enter the earth at the geomagnetic pole, causing disturbance to ionisation layers and temporarily destroying magnetic equilibrium.

The aircraft shown also represents a reasoned forecast of a type likely to be required for stratospheric flight. Esso are already evolving new fuels and lubricants to meet the conditions posed by such flight.

ESSO

Flight in the 21st century
is already the concern of Esso Technologists

ESSO PETROLEUM COMPANY LIMITED 36 QUEEN ANNE'S GATE, LONDON S.W.1. AVIATION TECHNICAL SERVICE, RELIANCE 1261

DESIGN FACILITIES

Aircraft Design Office

Landing gear
Hydraulic systems and components
Pneumatic systems and components
Power operated controls
Solenoid operated selectors
Fuel valves
Flameproof valves
etc.

ELECTRO-HYDRAULICS LIMITED

WARRINGTON
Telephone : Warrington 35241

PUTTING *MEANING* INTO DEFENCE

A new dimension of sea safety

The Canadair CL-28 is the most formidable search, strike and kill maritime patrol weapon in the air today. It is in quantity production for the Royal Canadian Air Force and is available for purchase.

The CL-28—a direct derivative of the Bristol Britannia—carries the most comprehensive collection of electronic and other detection equipment ever assembled into one aircraft for locating, tracking and 'fixing' enemy submarines—whether submerged, 'snorting', or on the surface. Once contact is made, torpedoes, depth bombs and other offensive weapons are released.

It was specifically designed for long periods of ocean patrol duty . . . tactical coordination with naval surface craft on defensive and offensive manoeuvres . . . convoy and search-rescue operations.

The CL-28 will meet or surpass the requirements of friendly countries responsible for the defence of coastlines and sea approaches. For full information, contact our European representative or write directly to vice-president/sales.

European Representative : J. H. Davis, Princes House, 190 Piccadilly, London, W.1, England.

C-L CANADAIR LIMITED

CANADAIR

LIMITED, MONTREAL, CANADA

• Aircraft • Research and Development
• Guided Missiles • Nuclear Engineering

A SUBSIDIARY OF GENERAL DYNAMICS CORPORATION

CAP-SKT-1

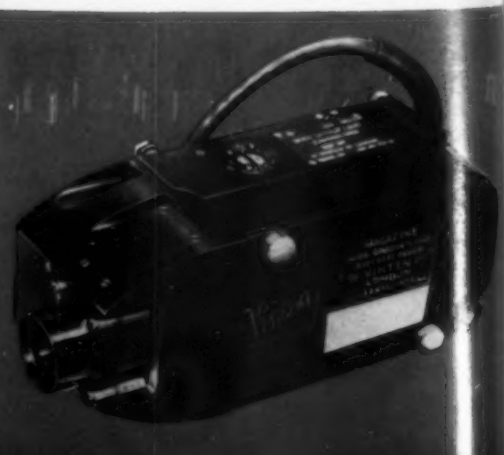
The "Firestreak" infra-red guided weapon.
Photograph by courtesy of De Havilland Propellers Ltd.

RESEARCH PHOTOGRAPHY

The design and development of the De Havilland "FIRESTREAK" was greatly assisted by colour photography using the Vinten 16mm High Speed Cine camera. This unique camera measuring only 8½ x 3½ x 3½ ins. and weighing less than 4½ lbs. greatly simplified installation problems and, as the results show, fully justified the confidence placed in its reliability.

The Vinten High Speed 16mm Cine Aircraft Camera as supplied to Aircraft Manufacturers and the Ministry. The colour photograph is an untouched enlargement from a 16mm frame.

Vinten



W. VINTEN LTD., NORTH CIRCULAR ROAD, CRICKLEWOOD, LONDON, N.W.2.
CINEMATOGRAPH EXPORT LTD., 715 NORTH CIRCULAR ROAD, LONDON, N.W.2.

The Folkestone Conference

"Flight" Photographs at Monday's Opening

THE technical sessions of the 6th Anglo-American Aeronautical Conference began at the Hotel Metropole, Folkestone, on Monday last, September 9, when the conference was officially opened by the presidents of the Royal Aeronautical Society and the Institute of the Aeronautical Sciences, and the Deputy Mayor of Folkestone.

Conference delegates, who numbered over 600, were welcomed to Folkestone by Councillor D. H. Brown, the Deputy Mayor. Sir George Edwards, the R.Ae.S. president, expressed the hope that delegates would not be too busy reading and discussing the technical papers to take advantage of the town's facilities; and went on to read messages exchanged between the Society and its patron, H.M. the Queen.

Mr. Mundy I. Peale, I.A.S. president, thanked the Institute's hosts for their hospitality in this country. Britain's recent White Paper on defence and the U.S. "austerity programme," he said, were different in wording but the same in meaning. The "guided weapon *versus* manned fighter," controversy was a common problem: manned aircraft—or manned air vehicles—would still be necessary in situations where the human brain was needed to deal with unprecedented situations. Mr. Peale concluded by reading a message from President Eisenhower, expressing wishes for a successful conference.

Monday's lectures and discussions were concerned with VTOL and STOL aircraft (an impressive colour film of U.S. work was shown by Mr. M. O. McKinney, of NACA); nuclear propulsion; the control of supersonic propulsion systems; and the electrical control of powerplants. The photographs on this page were taken during the opening day's proceedings.

(Summaries of the conference papers appeared in "Flight" for September 6; we hope to report the discussions, and to deal with some of the papers at greater length, in forthcoming issues.)

1

2

3

(1) The conference is declared open. Left to right: Paul Johnston, I.A.S. director; Cllr. D. H. Brown, Deputy Mayor of Folkestone; Sir George Edwards, R.Ae.S. president; Mundy I. Peale, I.A.S. president; Dr. A. M. Ballantyne, R.Ae.S. secretary.

(2) Delegates listening to the inaugural speeches.

(3) Marion O. McKinney (N.C.A.), the first lecturer, is introduced by D. Keith Lucas (Short and Harland), right.

(4) Edwin E. Aldrin, I.A.S. vice-president; Dr. Ballantyne; Robert R. Dexter, I.A.S. secretary.

4

(5) A. W. Thorpe (Avro), H. H. Thomas (R.A.E.), Dr. S. Neumark (R.A.E.).

5

(6) J. B. Edwards (Handley Page), J. S. Przemieniecki (Bristol), P. T. Fink (Imperial College), Prof. A. V. Stephens (Queens University, Belfast).

(7) L. A. Wingfield (R.Ae.S.), E. L. Bass (Shell), Marcus Langley (Tiltman Langley).

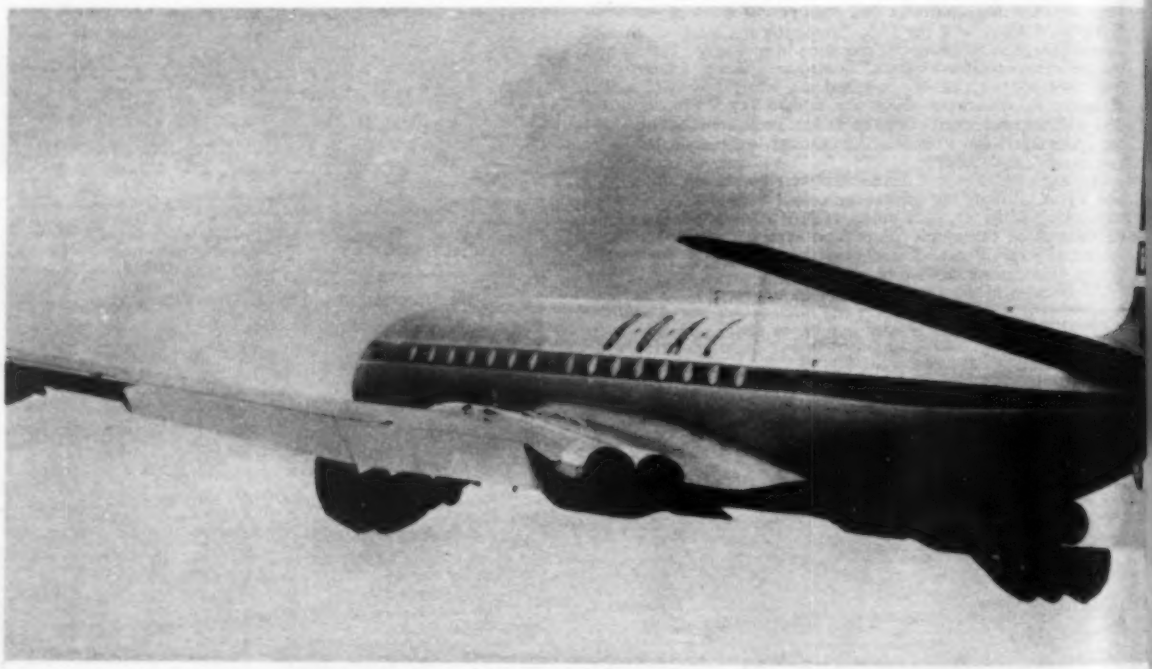
(8) E. W. Robischon, I.A.S. Western Region manager; Welman A. Shrader, I.A.S. director of publications.

8

7

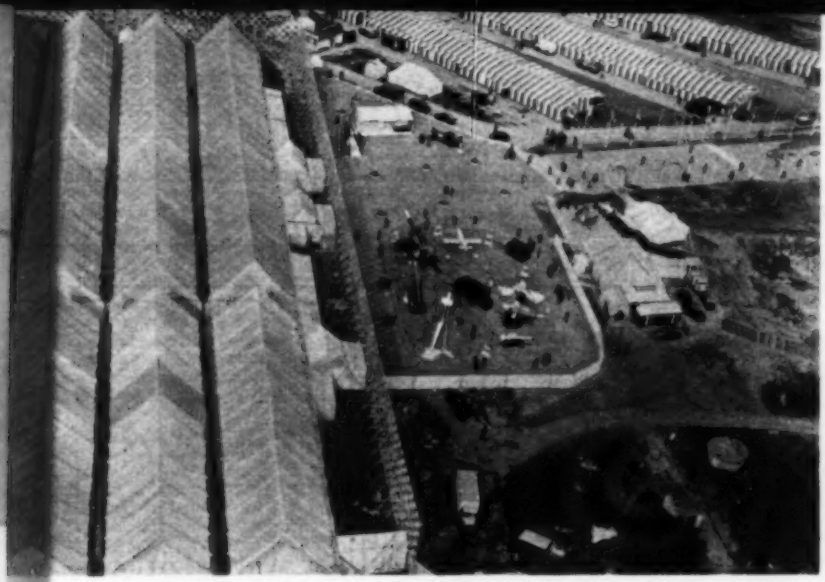
6

Sprightly Farnborough performers were the HDM.105 (left) and the two Westland Whirlwinds (above).



Aspects and Angles

Take-off impressions of the de Havilland Comet 3 (above) and (below, left and right) the English Electric P.1B, and Gloster Javelin FAW.4.



ILLUSTRATED MAINLY
WITH "FLIGHT" PHOTOGRAPHS

IT is probably true to state that the majority of people who go to the S.B.A.C. Display on the "public" days are unable to make more than a cursory examination of the indoor exhibition, for time is short and the crowds large. For these, then, we reiterate that the static show—part of the roof of which is visible on the left of the picture above—this year covered an area of 125,000 sq ft and housed 350 stands. Some of the most interesting new developments which were displayed are described below and in the following 16 pages.

ON THE GROUND

THE STATIC SHOW: NEW TECHNICAL DEVELOPMENTS REVEALED

A.C. GENERATORS AND CONSTANT-SPEED DRIVES

ALTHOUGH alternator drives governed to hold their speeds within close limits are by no means new, increasing interest in A.C. systems means wider application and increasing competition in this field. The classical method of design is perhaps the hydraulic unit (typified by the Sundstrand drive), but there are many variations on the theme, and air, mechanical, electrical and even cordite-driven units were on display.

Shown on **de Havilland Propellers** stand (see also p. 445 under the heading of "Guided Weapons") were an array (finished with typical D.H. care in pale blue) of alternators and drives for both missiles and other applications. The output of individual units were largely security-cloaked, but the powers of the missile range vary from 300 W to 3 kW intermittently rated and 5 kW continuously rated. Prime movers include oil, air and mono-fuels. Very close frequency and voltage tolerances are maintained over relatively large load changes. Methods of frequency control range from a single tapered needle to a combined throttle and off-loading valve and, as yet secret, devices using only static parts. All the metering devices are controlled by a special proportional relay operated through a magnetic amplifier unit.

One constant speed alternator and drive features a variable-swashplate hydraulic motor with an electronically controlled hydraulic throttle varied by measuring the alternator output frequency. Little information was forthcoming about the control arrangements, but an oil-filled electronic control box is a separate unit. This very high efficiency alternator drive has been in production for some months. Its application is probably connected with the company's hydraulic scanning unit for air interception radars; a G.W. frequency is used.

Other alternators shown were turbo-driven by bleed-air pressure and by cordite gas. Control over these prime movers is inherently less sensitive than can be obtained by other means. Inductor type alternators are used for simplicity, but the high inductive reactance necessitates capacitors in series with the output windings to increase output power. Special compensating circuits are provided to ensure that the harmonic impedance of the alternator is reduced to a minimum, thus allowing high harmonic contents in the loads without serious distortion of the fundamental sine wave.

The **English Electric** constant speed drive is of the "Sundstrand" pattern and is being built and developed under licence. Units of this type have now reached the early stages of quantity production. Governed speed operates over an input range of 2,850 to 8,300 r.p.m. and gives a closely governed constant output speed of 6,000 r.p.m. The alternator is designed to maintain 40 kVA (0.8 power factor) from ground idling to full throttle, and is being manufactured for an application where full electrical power is required for various services before take-off. The design is well suited to this application; there is a variable swashplate hydraulic unit on the input and a fixed-displacement unit on the output.

The output frequency of 400 c/s. is held to ± 1.0 c/s. for steady state conditions and holds the frequency constant during rapid acceleration, deceleration, or changes in load, to 400 ± 5 c/s. Similarly, load division between two or more alternators is held to 4 kW in the steady state and 14 kW under positive or negative loads. The weight of the hydraulic transmission including the governor, overspeed and assembly, is 78 lb.

An entirely new unit on the **H. M. Hobson** stand was the hydraulic constant speed drive Type 314. A feature of the display was a Perspex-encased demonstration model showing the motor and pump cartridge. Although at first sight this unit is similar to a Sundstrand design, the use of a fixed-displacement hydraulic unit on the input and a variable-displacement swashplate unit on the output confers special features to the design. Among these are that the maximum output of 20 kVA is given only at the upper end of the speed range, although 10 kVA is available at the minimum governed speed. This arrangement is suitable for specific applications and the system has the advantage that it is running at minimum hydraulic pressure for most of its working life. A further advantage of the Hobson design is that it enables the constant speed drive to be adapted as a hydraulic engine starter; this would not be possible with a reverse arrangement.

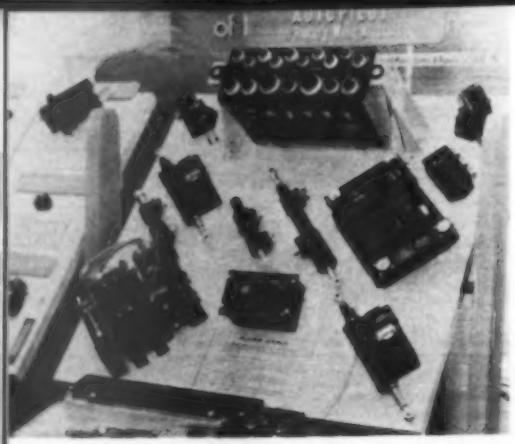
The output speed is controlled by a centrifugal governor and spring which determines the position of a servo valve and consequently the swashplate. There is a further governor to safeguard the system against overspeeding, and a torque motor and trimming mechanism to adjust the control valve and output r.p.m. in relation to other alternators in the system.

With an input speed range of 3,300 r.p.m. to 10,000 r.p.m., the controlled output speed is 8,000 r.p.m. ± 2 per cent. Control to within these limits is maintained with input velocity changes of up to 1,000 r.p.m./sec.

Rotol, Ltd., were exhibiting a range of bleed air turbine equipment driving 7.5, 15 and 40 kVA alternators. The motors, fed from compressed air bled from the main engine compressors, drive the aircraft accessories either direct or through a reduction gearbox. This type of accessory installation has the advantage that, under the control of a governor, a constant-speed drive is obtainable irrespective of load or engine r.p.m. changes.

For some years past, **Tiltman Langley** have been developing under contract (and displaying at the S.B.A.C. show) the Hayes

Armstrong Siddeley Motors air starter.



Louis Newmark produce this helicopter autopilot, which provides three-axis stabilization and automatic control (see Col. 2, below).

ON THE GROUND . . .

A.C. Generators and Constant-speed Drives (continued)

variable ratio transmission. This year a prototype unit was shown with the Hayes drive combined in a unit with an alternator. For variable input r.p.m. of 3,000 to 10,000, the alternator is controlled at 8,000 r.p.m. and has a 30 kW loading. Production models of the combined unit would be smaller and more refined, as the prototype unit has been made with a sufficiently large casing for further development work to be done.

The Hayes transmission is entirely mechanical, although the governor makes use of lubricating oil from the gearbox to operate a hydraulic relay which controls the output speed. There is a freewheel on the output which prevents the alternator attempting to reverse the drive through the transmission. The Laboratories say that there is an initial life—under conditions so far tested—of 500 hr before the transmission tracks begin to deteriorate.

Two manufacturers of alternators with interesting displays were **Vernon's Industries**, who are proud of their ability to control 200/115 V 3-phase 400 c/s. machines to within ±1 per cent in voltage and frequency, and **Plessey**, whose new 43 kVA alternator developed for the M.o.S. is used on Blackburn's Turbomécas; it has an application in the Blackburn airborne A.P.U. powered by an Artouste.

AUTOPILOTS

AN encouraging news item in the autopilot field was the approval by the American C.A.A. of the Smiths Flight System and the fact that this equipment is to be fitted to the Northeast Airlines Britannias. The complete system was exhibited on the **Smiths Group** stand.

The **Sperry Gyroscope Company** introduced the Flight Director Gyropilot which is the latest in their series of light- and medium-aircraft autopilots. It is a combination of the A.L.30 autopilot, for aircraft of Herald and Noratlas size, with the Sperry Zero Reader. Ailerons and elevator are controlled by pneumatic servos; and attitude and heading information are taken from electrically-driven Sperry Gyro Vertical and Gyrosyn compass. The main additional units are the Zero Reader Flight Director, and its associated coupler. The combination offers an efficient approach coupler for this small and light autopilot. Sperry also showed the computer and height lock sections of a military electro-hydraulic autopilot, but were not allowed to release any information about its application or capabilities.

A significant exhibit by **A. V. Roe, Ltd.**, on the **Hawker Siddeley Group** stand was the elevator channel of an autopilot suitable for either aircraft or missiles and capable of stabilizing a machine over a very wide range of conditions. Though lashed up for exhibition purposes (it used a conventional panel-mounted gyro vertical), many of the components were genuine missile parts. Signals were provided by the Gyro Vertical, a rate gyro and an accelerometer, the latter mounted well forward in the nose of the model. Avro's own longitudinal aerodynamic simulator was providing a series of thoroughly unpleasant disturbances which the autopilot was effectively counteracting. The function of the accelerometer was to provide control over the whole trajectory of a missile's or aircraft's flight path. Avro also produce aerodynamic simulators for the roll axis and for the effects of roll characteristics on pitch and *vice versa*. (See also p. 445.)

Louis Newmark, Ltd., have now revealed themselves as the producer of the autopilot for the Sea Vixen. Shown for the first time on their stand, it is a three-axis servo system designed to act both as a pilot aid and as a multi-axis stabilizer for fighter and fighter-bomber aircraft operating over wide speed and height ranges. Azimuth and vertical information is derived from a Master Reference Gyro; and signals related to damping terms are obtained from three rate gyros. A flight data unit gives signals proportional to Mach number, height and airspeed and these are used to vary the parameters in the servo system to compensate for changes in speed and height. An electric servo system provides yaw control, while electro-hydraulic systems give both roll and pitch control through the ailerons which for this purpose are used as elevons. Magnetic amplifiers are used throughout and the components can operate in high temperatures. The autopilot has Mach hold, speed hold and height lock facilities, and provides longitudinal damping under manual control. The weight is 60 lb.

The same company has produced an autopilot which is flying in a number of Fleet Air Arm helicopters. It provides three-axis automatic control and stabilization over a wide range of flight conditions by means of servo operation of the cyclic and tail rotor controls. Three rate gyros provide signals required to give the necessary damping terms in all modes of operation, additional attitude information required in the autopilot mode being provided from the pilot's flight instruments. A yaw computer produces yaw bias signals for different power settings. Magnetic amplifiers mix and amplify these signals to control electric servo motors in the yaw channel and the pilot's powered controls for the longitudinal and lateral axes. Electric clutches disengage the servo motor when it is not required. In addition, sensing devices are incorporated in the pilot's control runs so that electric demand signals are fed into the autopilot system by normal control movements. The stabilizing features of the autopilot can thus be used during manual manœuvring.

There are three operating modes. With "stabilizer" selected, the helicopter has "hands off" stability but does not hold any datum attitude or heading. The result is that the machine is stable, but all manœuvring is controlled by the pilot. With "cruise" selected, the stabilization is similar, but additional attitude information is used to provide long-term monitoring and maintain the helicopter in any desired attitude and heading. To change these conditions the pressing of a switch on the cyclic stick causes the autopilot to revert temporarily to "stabilize." The pilot then sets the machine to the new flight condition and releases the button to continue under automatic control. With "hover" selected, the mode is similar to that of "stabilizer" but a heading lock is linked to the yaw channel and the helicopter will maintain the heading irrespective of changes in height or power. Normal cyclic control remains. The press switch is also used while changing heading. The weight is 35 lb.

The Louis Newmark Auto Mach Trim System was shown. It consists of a position servo system designed to alleviate longitudinal trim changes that occur in aircraft as a function of Mach number. For this purpose, a Machmeter fitted with an A.C. pick-off is used as the signal source to the main magnetic amplifier and servo system. The actuator is a D.C. motor driving a ram connected to the elevator control run just aft of the feel unit.

The Newmark autostabilizer, also shown, is a complete electric control system for stabilizing high-speed aircraft against yaw oscillation. It includes a rate gyro; a monitor unit which uses an airspeed- and height-sensitive capsule to vary servo parameters according to aerodynamic conditions; a phase advance unit containing the main lag-lead network; a reliable and compact magnetic amplifier; and an output stage incorporating either electric or hydraulic actuators coupled to the rudder power-control or to the rudder spring-tab.

AUXILIARY POWER UNITS AND STARTERS

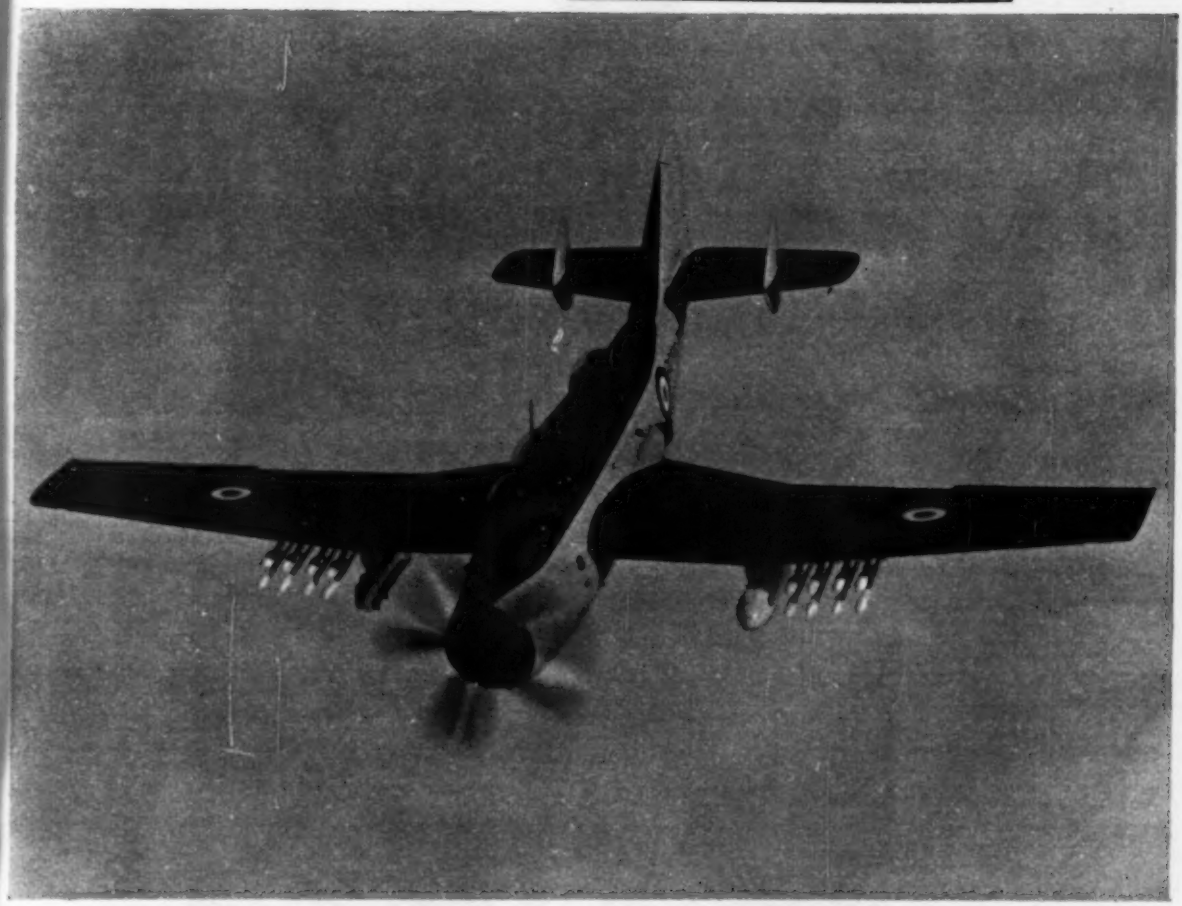
NEW from **Armstrong Siddeley Motors**—a contract for construction under licence from the AiResearch Manufacturing Division of the Garrett Corporation, U.S.A., was signed shortly before the show—are both auxiliary power gas turbines and air turbine starters. Of the first-named, five different units are available. They supply shaft power only, pneumatic power only or a combination of both pneumatic and shaft power.

In operation, air is ducted through a screened opening to a two-stage centrifugal compressor. Discharge air enters a single combustion chamber, and the combustion gases are discharged through a turbine into the atmosphere. Shaft power is taken from a turbine-driven output shaft, and compressed air is diverted from the compressor discharge. The advantages claimed for these units are high output and light weight, an operating temperature range of ±54 deg C, uncontaminated bleed-air, long life, operation on a wide range of fuels, and simple operation.

A typical unit in the range (which provides shaft horsepower varying from 100 to 450 and 117 to 240 lb/min of compressed air supply) is the G.T.C.P.100. This is a combination unit which will provide 135 lb air/min at sea level as a bleed source only with no output shaft, or a maximum of 120 lb/min airflow as a combination unit. The maximum shaft horsepower at S.L. (no air bleed) is 150 h.p., and 90 h.p. at 20,000ft. These performance characteristics assume no external losses and no ram recovery.

Applications for the unit are installation as an auxiliary power unit in an aircraft to provide shaft or pneumatic power independent of the main engines. The unit can also be used as an emergency power source and on the ground to make the aircraft independent of support equipment. Alter-

FAIREY GANNET



The Fairey Gannet has proved in service to be the world's most successful anti-submarine aircraft, combining the ability to search and to strike with the most formidable modern weapons. Powered by the Armstrong Siddeley Double Mamba, it has twin engine reliability. These aircraft are in service with the Royal Navy and the Royal Australian Navy and are on order for Western Germany's Naval Air Arm.

THE FAIREY AVIATION COMPANY LTD

HAYES · MIDDLESEX

ENGLAND · AUSTRALIA · CANADA

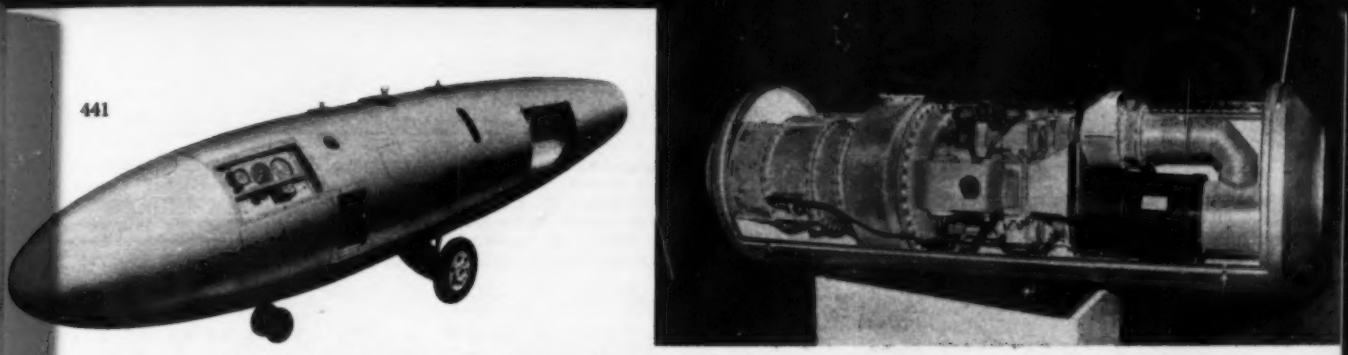
REMEMBER POPPY DAY

– is widely travelled

and frequently flies by HERON

Powered by four de Havilland Gipsy Queen engines driving de Havilland propellers

DE HAVILLAND WORLD ENTERPRISE



Pneumatic and shaft power by Blackburn turbines: the Palouste low-pressure air starter (left) arranged in air-portable pod form (for the R.N.) and the Artouste driven airborne power plant in its cylindrical container for mounting in an aircraft.

ON THE GROUND...

Auxiliary Power Units and Starters (continued)

natively, it can be mounted in a mobile ground vehicle or in an auxiliary aircraft pod for transportation as a self-contained piece of ground equipment.

The unit can, of course, drive various electrical A.C. or D.C. accessories; a frequency control system allows the unit-driven alternator to be paralleled with other alternators driven by engines employing a similar control system. The G.T.C.P.100 weighs 245 lb.

The Armstrong Siddeley low pressure air starter is claimed to offer the lowest installed weight on multi-engined aircraft, even with a gas turbine compressor air source aboard; this may also be true of single-engined aircraft if the compressed air source is part of the ground equipment. The new range of licence-built starters provides torque from 5 to 550 lb-ft with a maximum weight of 27 lb.

The starter is operated by compressed air supplied by air or ground equipment. To increase the energy level, a line combustor may be added to this low-pressure pneumatic starting system, and for quick, tactical starts a combination starter is available which provides for cartridge as well as air starting. A further development combines low-pressure air and fuel/air starts. The A.S.M. units can be rotated for extended periods, require only nominal servicing and can be controlled in output r.p.m.

The **British Thomson-Houston Co.** exhibited their liquid monofuel turbostarter. This has been developed to replace the cartridge starter, which has various disadvantages, not the least of which is accessibility. The fuel used is iso-propyl nitrate, requiring no air or external agent to initiate decomposition and is lighter than a solid fuel starter. The starter shown could be adapted to very large engines.

Incorporating a Palouste 500, the low pressure air starting pod shown by **Blackburn and General Aircraft** will be used as squadron equipment where engines fitted with low-pressure air starters must be started-up. It is a completely self-contained unit in a streamlined pod, and it can be carried on aircraft external store pylons. The tricycle undercarriage is retractable, and forms part of the equipment; the wheels are removed when the pod is slung. The pod is 180in long and weighs 970 lb.

An A.P.U. from Blackburn is the 475 h.p. Artouste 510 airborne unit. The engine, with its inlet and exhaust ducts and A.C. generator cooling shroud, is enclosed within a cylindrical container intended to be mounted within the aircraft. The unit on display (shown in the photograph) had a plastic cover through which the internal arrangements could be seen. Electric, hydraulic, pneumatic or vacuum power can be provided. The show unit was equipped with a 43 kVA Plessey alternator. The length of this A.P.U. is 73.5in, diameter 24in, and weight about 400 lb.

Low-pressure air starters were featured on the **Plessey** stand. As with the units previously described, these are built under licence from America—from the Hamilton Standard Division of the United Aircraft Corporation of America. The starters incorporate an engaging mechanism, an epicyclic reduction gear, and a simple and positive quick release mounting. A speed sensitive switch shuts off the air supply at the end of the starting cycle. Another feature is a free-running characteristic which prevents accidental overspeed under normal inlet conditions. The air supply can come from a ground supply of compressed air or from stored air or steam.

The static torque is 220 lb-ft at an 8:1 gear ratio with the Model PTSC.220, and 400 lb-ft at a 14.65: 1 gear ratio with Model PTSA.400. They weigh 20 lb and operate at an air mass flow of 1.82 lb/sec.

A range of A.P.U.s and starters is also manufactured by the **de Havilland Engine Co.** These operate on high test peroxide, and the A.P.U. will function at very high altitudes. The starter uses about 11 lb of fuel per start, has an integral gearbox, is 15.6in long, 5.8in diameter, and weighs 46 lb. It is normally mounted in the intake bullet.

CABIN AIR SYSTEMS

GENERAL development of air-conditioning and oxygen systems is continuing, with particular emphasis on the liquid oxygen which is now becoming standard. **British Oxygen Aro Equipment, Ltd.,** have a new spherical capacitance probe for accurately measuring liquid-oxygen container contents regardless of aircraft attitude. This is a distinct advance over the previous American float and straight capacitance-probe systems. The spherical probe signals are passed to the contents gauge through a transistor amplifier made by the General Electric Company. The same lox system includes an economizer specially arranged to avoid the losses which normally occur between the gasification and delivery stages of standard systems.

British Oxygen Aro Equipment exhibited a suggested layout and some components for a 100-man liquid oxygen system designed for both crew and passenger use in large airliners. The supply tube could be automatically presented at each seat out of a hidden pocket; and oxygen would only flow when the passenger pulled the tube and thus extracted the breathing mask. It was suggested that the mask itself might be designed to stick to the face for a short time without any retaining harness.

Sir George Godfrey and Partners, Ltd., showed a new range of temperature-control and pressure ratio valves and new vertical (as opposed to horizontal) cold air units. Advantages of the latter are simplification of bearing and lubrication arrangements because of the vertical alignment of the shaft and, in one case, an outboard bearing which runs outside the very high temperature gas flow. These units are very small.

Gloster Aircraft, Ltd., exhibited a very small system for controlling the temperature of air taken from the normal cabin pressurization supply and fed to aircrew ventilating suits. The mixing of hot and cold air is controlled by a bimetallic-strip valve.

Normalair, Ltd., suggested an integrated air-conditioning and pressurization system for a future supersonic airliner, comprising vapour cycle cooling, air turbine starting, airborne power unit, pneumatic ancillary drives, automatic pressure-, temperature-, humidity- and flow-controls and a lox system for crew and passengers. Also on this stand were examples of a new range of butterfly valves.

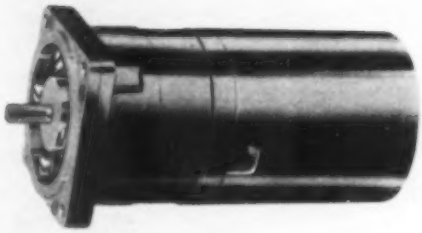
ELECTRIC AND PNEUMATIC UNITS

EACH year a range of new or improved actuators appears on the stands of the static exhibition as new applications are found and techniques developed to provide more power for less weight or size than hitherto.

Two new air motor-driven units have been developed by **Plessey.** These are the ram 5000/50, and small air motor actuator 100/6. The former is an air motor unit with an actuator of the recirculating ball type. It can be operated by engine compressed air or from a stored supply. A feature of the unit is its rapid response to variations in air pressure, and its ability to reverse its direction of motion in a very short time. It incorporates shock-absorbing devices to reduce impact loading at the extremes of travel. The maximum thrust is 5,000 lb, stroke 5in and weight 33 lb. The smaller 100/6 unit weighs 4 lb and has a stroke of 0.6in. It is designed for use in single and multi-actuator systems. A new Cub Jaguar electrical actuator was also revealed.

Plessey also showed a new 3 kVA invertor, Type C5628A. Designed to convert general-purpose D.C. in aircraft supplies to 3-phase A.C., a feature of this invertor is its extremely high power to weight ratio. An integral control box houses starting gear, radio suppression, and equipment for frequency and voltage control. The input voltage is 25-29 V D.C., and output 3 kVA at any power factor between 0.8 lag and 0.9 lead at 400 c/s., 200 V, 3-phase A.C. The temperature range is −30 deg C to +45 deg C, and the weight 60 lb. The C5628A will be supplied to Vickers for B.E.A.'s Vanguards.

A pneumatic actuator, designed to operate the variable area of a jet pipe afterburner, was shown on the attractive stand of **Sir George Godfrey and Partners.** The basic unit can also be used to operate wing flaps or radiator shutters. It comprises a Roots type air motor, reduction gears and a control mechanism consisting of a feed-



Plessey's S1510 squirrel-cage actuator motor, capable of operation at up to 250 deg C.

same concern is engaged in the manufacture of a twin motor actuator which will tolerate failure of one motor; the actuator will continue to work at half power and half rate. The two motors are mounted above the ram and the unit features a screw jack and epicyclic gearbox. The firm are also displaying a most noteworthy magnet coil which has been developed to work at 800 deg C. The insulation will stand appreciably more heat than this, but temperature is limited by soak to the windings.

ENGINES AND ACCESSORIES

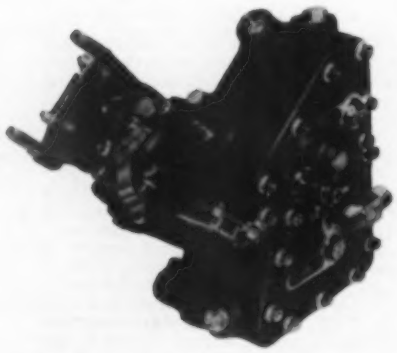
ON THE GROUND...

Electric and Pneumatic Units (continued)

back shuttle and a piston valve air throttle.

A new actuator from **English Electric** is the Type AE.4005 miniature linear actuator. Both wound field and permanent magnet types are available. It is designed for low load trimming and similar application; the normal load is 30 lb, maximum load 45 lb, maximum static load 90 lb, stroke 1.0in and speed 0.22in/sec., although other speeds are available.

Western Manufacturing (Reading) are showing the biggest actuator they have yet made—a 4,500 lb design for Fiat! This is claimed to be one of the largest of its kind in general use and has a maximum output load of 6,000 lb. Visitors to the stand may well have been surprised at the compact dimensions of this powerful unit. The



Sir George Godfrey and Partners: PA-15 actuator, incorporating a Roots-type pneumatic motor, designed for operating afterburner shutters.

DEVELOPMENT of the Leonides Major, by **Alvis,** is steadily going forward. Fixed-wing and helicopter versions were on view and the chief models are the Type 702/1 for the Herald (maximum take-off rating 875 h.p. at 3,000 r.p.m. with 9.25 lb boost), the Mk 151 for the Bristol 173 (860 h.p. for one hour) and the Whirlwind's Mk 155 (780 h.p. at 4,250ft for one hour).

A new gas turbine is the P.181/182 series (described in our August 30 issue) by **Armstrong Siddeley Motors.** The 181, which was the subject of a complete display exhibit (see August 30 issue), is a free turbine, omni-angle unit principally for helicopter applications. Output is remote from the intake end, at which are found the generator, iso-propyl nitrate starter, combined fuel pump and Lucas pressure-drop control system and the blower for the oil cooler. Immediately to the rear is located the integral oil tank, which occupies an annular segment around the first-stage compressor impeller.

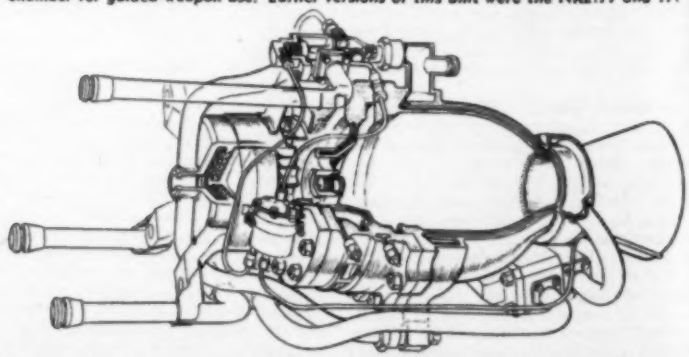
Another new engine is the P.187, the latest in the Viper family. A development of the ASV.11, the P.187 is similarly rated at 2,500 lb static thrust. Weight has been cut by 70 lb by the adoption of Fibreglass blading in the first compressor stage and magnesium-zirconium alloy for the centre section.

Blackburn and General Aircraft were cleared to exhibit the airborne starter pod, housing a Palouste air compressor, and the airborne auxiliary powerplant (A.A.P.P.); both are described on page 441.

A revelation by **Bristol Aero-Engines** was the BRJ.801 ramjet. Bristol have long proclaimed that the name Thor embraces a family of engines, and the 801 is slightly fatter (18in) and appreciably longer than the original unit. A development engine, it has numerous design features which differ from those of its predecessor. The diffuser angle is reduced, and a double skin is fitted in this region through which cooling air flows to escape from peripheral slots at the beginning of the combustion section. Bristol showed the Orion this year for the first time, and another engine worth mentioning was the Mk 6/3 Olympus, of Olympus 200 rating at 16,000 lb dry, which this year was a genuine powerplant which had actually been cleared for installation in a Vulcan B.2.

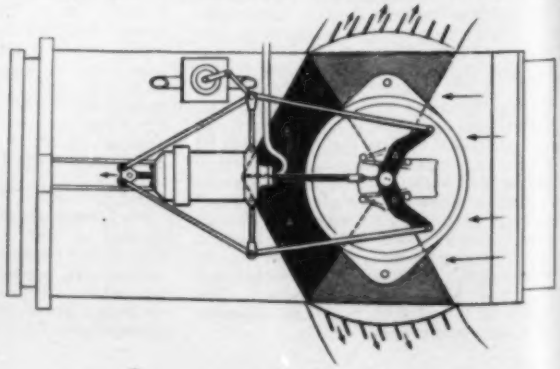
One of the differences noted this year on the outstanding Gyron Junior turbojet by **D.H. Engines** was the addition of a large collector manifold around the rear of the combustion section. This manifold is

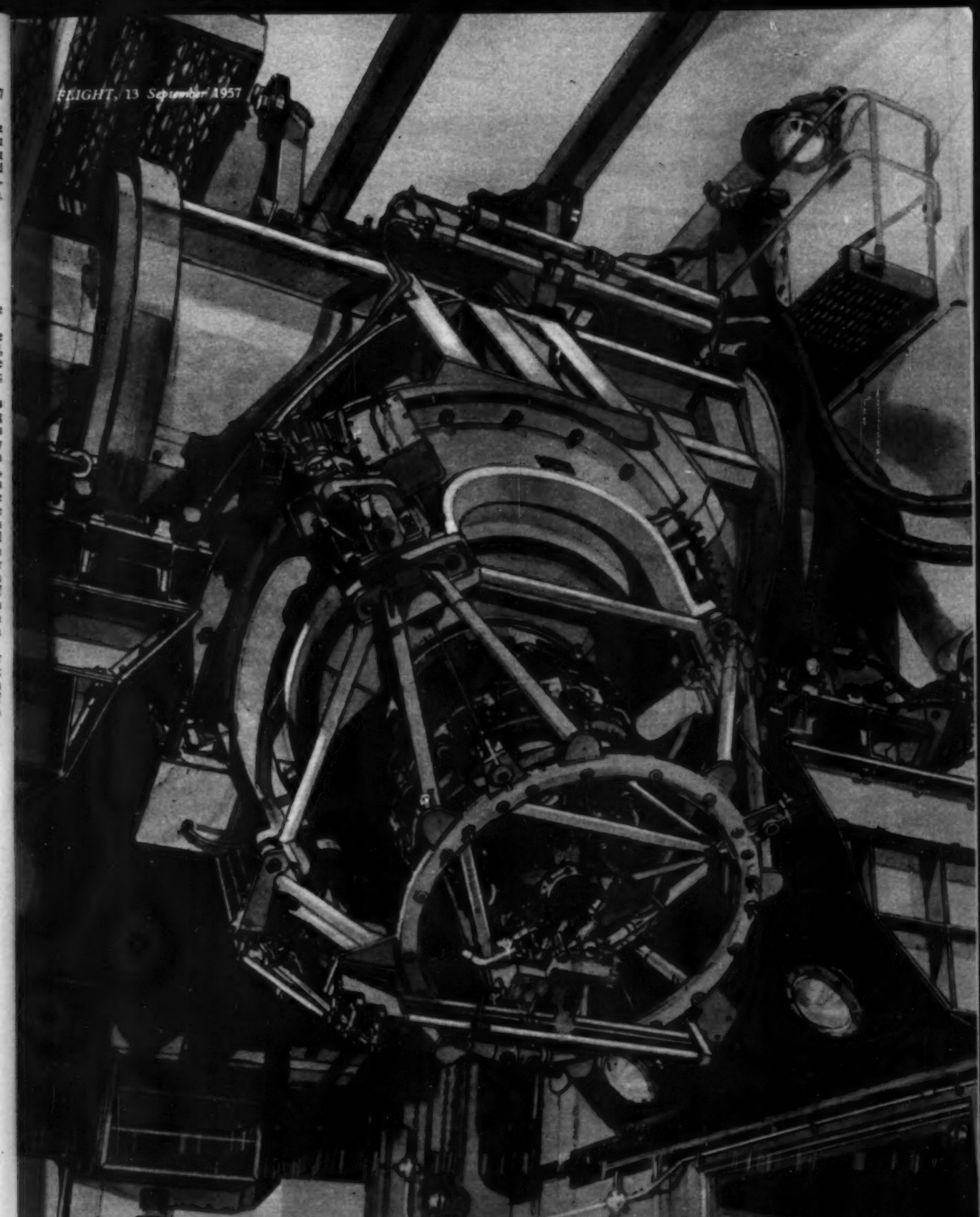
The drawing below depicts the principal details of a Napier liquid-propellant rocket motor chamber for guided-weapon use. Earlier versions of this unit were the NRE.11 and 17.



Two Bristol ramjets: the Thor (below) and the larger and more advanced BRJ.801. The Bloodhound surface-to-air weapon is powered by two of the smaller engines, which have a ruling diameter of 16in.

Diagram of Rolls-Royce thrust-reverser: A and B are clamshell shutters and their linkages which, when closed (black), seal off the normal nozzles and open the side cascades. Operation is by a Dunlop ram.





ALVIS

TESTED AS INSTALLED

A Leonides Major on the unique universal Dynamometer bed

ALVIS LEONIDES Aero Engines

ALVIS LIMITED · COVENTRY ENGLAND

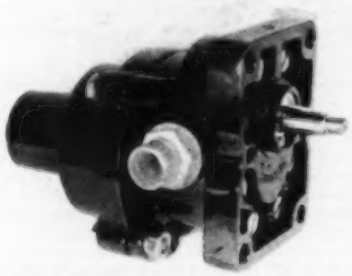
Mk.5

The Martin-Baker Mk.5 Ejection Seat is now being delivered in quantity to the United States Navy.

MARTIN-BAKER

Aircraft Company Limited

England & Canada



The Plessey fuel-control unit for small gas turbines consuming about 25 gal/hr.

ON THE GROUND . . .

Engines and Accessories (continued)

provided with pipe-attachment faces (two large and one small) on the underside of the engine, and could serve a flap-blowing mechanism or various other functions which may not yet be disclosed. D.H. Engines were also exhibiting a fairly recent type of Spectre controllable rocket engine (*Flight*, August 23).

The new developments by **Napier** were the Double Scorpion twin-barrel rocket engine, first described on August 30, and a liquid-propellant missile motor which the company were allowed to show in sectioned form. Another relaxation of security permitted Napier to display the diametral centre-body housing fuel tanks, control system and injection nozzle for the supersonic ramjet which they have built in some numbers under contract to the N.G.T.E.

Described in our September 6 issue, the **Orenda Engines** Iroquois two-spool supersonic turbojet was exhibited in a very well finished display form.

One of the new gas-turbine engines was the **Rolls-Royce** RB.108 turbojet, reported to have a rating of 1,810 lb-thrust. This engine clearly comes into the same class as the Soar, and like its predecessor has an excellent thrust/weight ratio. Unlike the Soar, the RB.108 is not entirely of monocoque construction but has a relatively conventional compressor casing and main frame. The compressor is obviously axial with a moderate pressure ratio, and the combustion section is evidently annular or can-annular. The exterior of the engine is very clean and contains rigid pipe for fuel and bleed air, and one of the few accessories is a Hobson control unit. The engine exhibited had its intake blanked off, and was supported (in the vertical position) by twin trunnions on the main frame. Four 108s are mounted in this manner in the Short SC.1 research aircraft, for which they provide jet lift. The RB.108 was illustrated on page 397 of last week's issue.

Other engines exhibited by Rolls-Royce included a Conway (RCo.5 type), a 520-series Dart, a 524-series Avon (RA.29) and a Tyne. In addition there was a reverse-thrust nozzle, as illustrated in an accompanying diagram, and a quiet-running Greatrex-type fluted nozzle. Not previously exhibited was the reheat nozzle of an advanced afterburning Avon, probably an RA.24R. Unlike the RA.7R's twin clam-shell nozzle eyelids, this pipe had a multi-segment nozzle with 8 small hinged flaps. A clue to the application of this unit was provided by the words "upper engine" on a name-plate.

Sperry showed a new turbine-engine cockpit vibration indicator. Any excessive vibration can, if it continues undetected, mean costly repairs. Sperry offer two systems; they may well become as widely used in turbine aircraft as are exhaust analyzers (also Sperry) in piston-engined aircraft. The basic equipment comprises a pick-up which can be mounted anywhere on the engine; an amplifier; and a galvanometer dial in the cockpit to indicate the vibration level.

New on the **British Messier** stand was a device for locking the Dart engine on the ground to promote fast turn-round time; the unit (in the input to the accessories gearbox and incorporating a small Dunlop hydraulic brake) is linked with the Viscount's air-stairs.

Plessey showed new engine-driven fuel backing pumps, supplied for the Rolls-Royce Conway (BP.200) and Tyne (BP.34). These were developed mainly in view of American civil airworthiness regulations, which require that engine power shall be maintained even with aircraft fuel tank booster pumps switched off or unserviceable. In effect, the units replace the duplicate fuel-tank pump, and are capable of pumping all types of fuel in the unfiltered state. Plessey showed also a new little fuel control unit for small gas turbines, designed to supply fuel to turbines which have a requirement of about 25 gal/hr.

Shown for the first time by **Tecalemit** was an ingenious water-separator suitable for installation on fuel bowsers. It is the design of the American firm, Bendix Skinner, and is to be manufactured by the British company.

Saunders Valve showed a new flap type non-return valve for fuel systems, the much higher flow efficiency claimed for it being convincingly demonstrated by sectioned, animated displays. Size for size and pressure for pressure, the flap valve should be considerably more efficient than conventional spring-operated non-return valves.

Dowty showed, in section form, the Gyron Junior's single circuit spill-burner fuel system. Recent important developments in this type of burner system for supersonic flight were not displayed.

An important development by **British Oxygen** was the B.O.A.E./L.N. liquid nitrogen system for the protection of aircraft fuel tanks against fire. B.O.A.E./L.N. makes use of the fact that a gas mixture of oxygen and nitrogen will remain inert provided that the oxygen content does not exceed a given value. Liquid nitrogen is injected into the air used to pressurize the fuel tanks, so that under all conditions—lightning-strikes, kinetic-heating, combat, etc.—the gaseous mixture remains inert. As an explosion-suppression system it appears to be the simplest and lightest yet devised; it weighs 15 lb per 1,000 gal of fuel.

Marston Excelsior showed flexible fuel tanks made out of the new lightweight "Marlite," and the **Self Priming Pump and Engineering Co.** an impressive display of fuel-system components, including booster pumps driven electrically, hydraulically, or by air-turbine. Probably the widest range of fuel pumps offered was that by **Pulsometer**—units for flow-rates from 10 gal/hr to 30,000 gal/hr.

A revolutionary aircraft refuelling dock, "designed for the jet age," was a surprise sprung by **Esso.** This is proposed as an alternative to expensive hydrant schemes, which, as parking aprons are expanded, may require continual alteration. The new Esso idea is that the refuelling dock would be constructed in selected areas, and aircraft towed to them after the embarkation of passengers and freight. A design has been proposed for London Airport, but has not yet been finally accepted.

THE OUTDOOR EXHIBITION

THE equipment exhibition outdoors was, as usual, larger than in the previous year. Here were displayed the bulky ancillaries to the aircraft operating industry, military and civil, which cannot readily be accommodated indoors.

One of the first items to strike the eye on entering this "exhibition within an exhibition" was the large grey bulk of **Airtech's** mobile automatic V.H.F. direction finder, alongside their mobile independent transmitting station (4 kW, 28 Mc/s.). **F. G. Miles** (whose name once again featured in the flying display, with the H.D.M. 105 and the Student), displayed their widening aeronautical interests in the equipment exhibition. Numerous fancy shapes in high pressure moulded Durestos were noted, including a 100 gal drop tank and a radar scanner.

An eye-catcher in a burnished bronze finish on the **Auto Diesels** stand was the "Stad" gas turbine compressor for use with crash tenders. The usual array of aircraft starting and servicing equipment, and a diesel fire pump, were shown also.

As in previous years, there was no shortage of volunteers for the **Martin-Baker** mobile ejection seat training-tower. Its desultory detonations throughout the show were an incidental piece of showmanship which attracted visitors to the whole equipment exhibition. **Zwicky** showed their 1,560 gal "Clyde" pressure refueller, painted in Shell Mex and B.P. colours, with a reminder on the vehicle's cabin door that Shell Mex are, by appointment, "Purveyors of Motor Spirit to Her Majesty the Queen." **Zwicky** showed also their runway sweeper, a yellow monster which is likely to be an inhabitant of more and more runways during the forthcoming jet age, when the problem of debris ingestion by podded jet engines is likely to be serious. The Mk FE1-10 can sweep 72,000 sq yd per hour.

From **Lucas/Rotax** came the hum of working test rigs, mobile and permanent, for testing the serviceability of gas turbine systems. An elegant passenger embarkation stair, hydraulically operated and shown in B.E.A. colours, was exhibited by **Edgehill:** like other tall structures in the equipment exhibition (such as the "Giraffes" and "Zip-Up" maintenance stagings showed by **Access Equipment,** and the servicing and maintenance equipment built up from "Basix" components made by **Aero Controls**) provided a good vantage point for privileged visitors to watch the flying display.

Shown for the first time by **Flight Refuelling** was their airborne hose drum package unit (Mk 16) as supplied to the R.A.F., no doubt for the mid-air refuelling of V-bombers. The unit was shown on its ground servicing trolley, and a display demonstrated the system of operation. **H.M.L. (Engineering), Ltd.,** also showed mobile aircraft test rigs, and displayed attractively (in pink and grey) their hydraulic tyre remover. Crash and fire tenders, painted in traditional red (U.S. authorities appear to be adopting yellow), were again a prominent feature of the equipment exhibition, with **Pyrene** and **General Fire Appliance Co.** exhibits displayed.

ON THE GROUND...

GUIDED WEAPONS

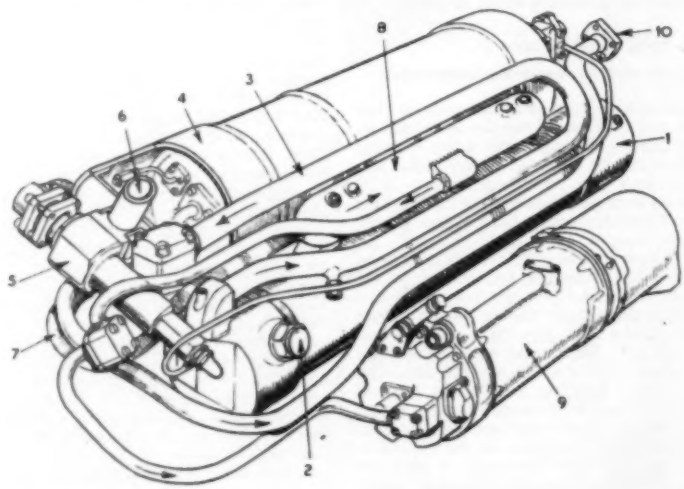
One of our principal missile companies is **Armstrong Whitworth**, for a decade the prime contractor for the Royal Navy's anti-aircraft weapon, the Sea Slug. Both sectioned and development examples of this missile were on view at Farnborough. (They have been described previously in our pages.)

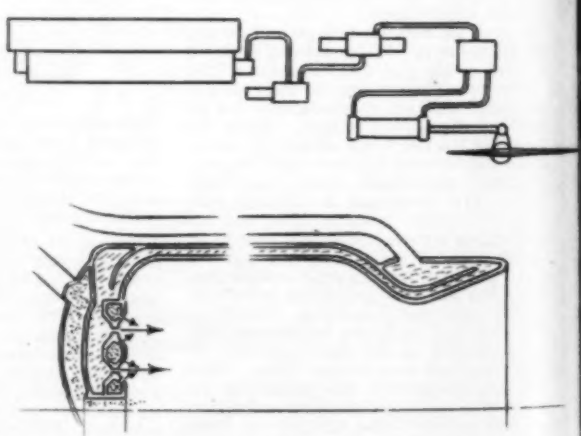
Of great interest were two missile power packs, one driven by cordite and the other by iso-propyl nitrate (i.p.n.). A rudimentary cold-cordite unit was tested about three years ago. The present pattern has a "cigarette-burning" cordite stick, inhibited by an ethyl cellulose coating, ignited by an electric-pyrotechnic fuse. Water-methanol coolant is vaporized in a long U-pipe and the resulting cooler mixture is passed to a constant-pressure relief valve and thence through a filter to the hydraulic system and the turbo-alternator. The latter is by D.H. (*q.v.*). Total weight, excluding the alternator, is 72 lb.

Use of i.p.n. propellant confers great advantages. Not only can it lead to space- and weight-savings (the unit exhibited weighed 44 lb), but it is much more efficient in answering varying demands. Cordite must burn at peak gas-production rate, the excess being dumped overboard; i.p.n. can be fed at the rate required. A.W.A. describe their TP-1 gas generator in the following terms:

"This gas generator has been designed to operate the power supplies equipment of a particular guided missile, and is required to deliver gas at a temperature of 400 deg C and a pressure of 625 lb/sq in. Since i.p.n. burns at approximately 1,200 deg C it is necessary in this design to cool the products of combustion by injecting a mixture of water and methyl alcohol. Fuel and coolant are contained in a single light-alloy cylinder, from which they are expelled by pressurizing a coupled piston assembly by gas tapped off from the combustion chamber. The system is thus self-sustaining and requires no auxiliary pressurizing medium. The pistons are so designed that a differential pressure of 100 lb/sq in above the gas working pressure is imparted to the fuel, and 10 lb/sq in to the coolant. Since the pistons are rigidly connected, a constant mixture-ratio of fuel to coolant is maintained at all times. From the expulsion cylinder the fuel is fed through a swirl atomizer and burnt in an uncooled stainless-steel combustion chamber. The coolant is also passed through an atomizer prior to injection into the hot gas stream downstream of the combustion chamber.

"Gas pressure is maintained sensibly constant by regulating the supply of fuel by means of a valve set in the closure plate at the fuel end of the expulsion cylinder. The reference pressure for operating this valve against a spring datum is tapped off the combustion chamber. In order to confine the coolant and i.p.n. to the expulsion cylinder during storage, pressure-operated coolant and fuel isolating valves are sited in the fixed centre ring and fuel end closure plate respectively. The unit is started by means of an uninhibited solid rod of cordite. To ensure a rapid rise in system-pressure when starting, the gas feed to the driven machinery is initially isolated from the remainder of the unit by a shear disc which fails at 130 per cent of the normal working pressure (which is 625 lb/sq in). A filter



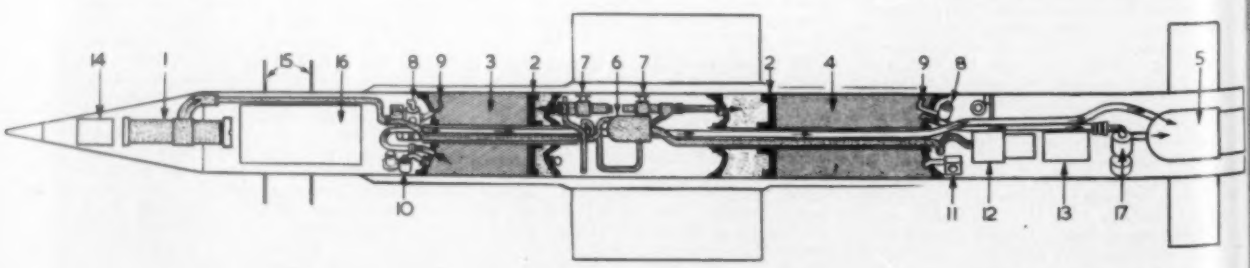


A.W.A. missile power packs are described in the text on this page. The diagram above shows the cordite-energized unit.

(1) Cordite cylinder.
(2) Igniter.
(3) Hot gas to cooler.
(4) W/m coolant.
(5) Relief valve.
(6) Spill.
(7) Cool gas delivery.
(8) Filter.
(9) Turbo-alternator.
(10) Gas to hydraulics.

(1) Gas generator.
(2) Propellant-tank free pistons.
(3) Fuel (methanol).
(4) Oxidant (nitric acid).
(5) Combustion chamber.
(6) Gas filter.
(7) Gas relief valves.
(8) Vent valves.
(9) Vents.
(10) Methanol filling.
(11) Acid filling.
(12) Turbo-alternator.
(13) Alternator control.
(14) Accelerometer group.
(15) Aerials.
(16) Guidance system.
(17) Servo filter.

The diagram below locates items in a Sea Slug development round; above are details of the servo-control system and the combustion chamber, which burns nitric acid and methanol.



Anywhere in the World is an Airfield..!

WINGS DAY SEPT. 14th
GIVE FOR THOSE WHO GAVE

A hundred yards, or so, of reasonably level ground is all that the Twin Pioneer needs. It can land at bicycle speed in 100 yards; can take off in 85. With its unlimited utility and 'put-down-any-place' performance, the Twin Pioneer can carry the countless benefits of air transport simply and cheaply, to anywhere in the world.

16 PASSENGER Twin Pioneer

POWERED BY ALVIS LEONIDES ENGINES
FITTED WITH DE HAVILLAND PROPELLERS

SCOTTISH AVIATION PRESTWICK AIRPORT · AYRSHIRE Phone: Prestwick 79888

SHELL

This is more than a trademark, it is a guarantee

ON THE GROUND...
Guided Weapons (continued)

entraps the sheared portion of the disc. The complete system attains normal working pressure in less than 0.5 seconds; overall run-time is solely dependent upon overall gas demand."

Avro A number of demonstration exhibits gave a necessarily incomplete and preliminary indication of the work of the Avro Weapons Research Division. One working model clarified the operation of an auto-stabilizing system for a missile flying in gusty air. The pitching plane was chosen, the model being disturbed by the injection of a sinusoidal gust. Position, rate and acceleration were measured by a position-gyro, rate-gyro and accelerometer. A computer (of Avro design and manufacture) was used to insert the aerodynamic parameters and physical characteristics of the vehicle, and the signals were mixed and fed to the control-surface loop. A novel feature was the use of an accelerometer (of the mass-type, mounted in the nose) as a stabilizing system. All the components were actual Avro "hardware."

An adjacent rig exhibited a control loop for fin position (the control surface itself was of curious plan-form). The output from a pair of synchros was passed through a magnetic amplifier and used to drive a modified Laws relay which operated a valve for a pair of hydraulic jacks. The latter were arranged to govern fin position, with a torque of 3,000 lb-in. Injection of a sinusoidal wave-form with a frequency up to 15 c/s formed a closed loop, indicating a flat amplitude response with full inertia load (aerodynamic loads naturally could not be applied).

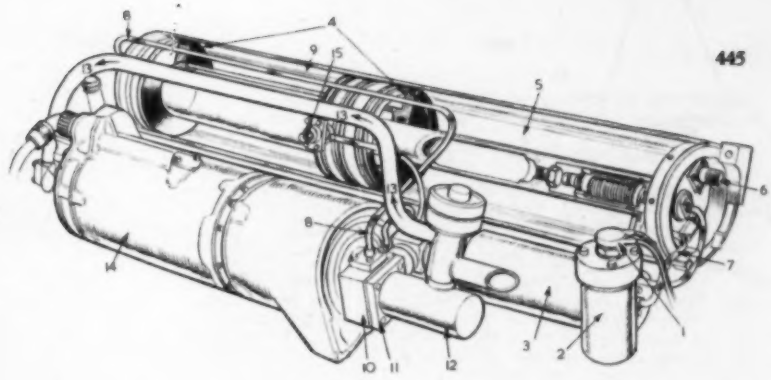
Another exhibit by the Weapons Research Division was a polar diagram plotter for determining the radiation pattern from a guided-weapon aerial. This is a very important factor, particularly having regard to the extensive use made of suppressed aerials. Both the plotter and an accompanying display unit showed much ingenuity and should give very rapid results. Avro also displayed a g-meter, a constant-potential battery charger and a battery-operated cathode follower.

Well known as the holders of such trademarks as "Cocoon" and "Texicoon," **R. A. Brand** displayed a Texicoon re-usable envelope for a Firestreak air-to-air weapon. The cover is sprayed on to a dummy round (without wings or controls) and then forms a long-lived envelope which can be zipped on or off missile bodies required to be stored or transported in adverse conditions. The Texicoon bag, of the Mk 2 grade, weighs about 10 lb.

Close inspection of the Bloodhound display exhibit left one in no doubt that **Bristol Aircraft** have done a fine job with this, our first production anti-aircraft weapon system. It was described in our issues of August 30 and September 6. It is fired from a zero-length launcher, the pivoting arms of which have slots at their upper ends which hold horizontal locating pins on the lower boost-motor cases.

Bobbin, the twin-Thor ramjet engine test vehicle had been seen before, but Borzoi was something new—a long 13in diameter ballistic vehicle designed and built by Bristol's Weston Division for flight testing I.C.I. solid-propellant boost motors. The latter, rated at 45,100 lb thrust for 5.1 sec, are made by I.C.I. at their Summerfield Research Station at Kidderminster.

British Messier Three years ago this company were able to exhibit a missile servo-control ring—one of the first G. W. components ever to be publicly shown in this country. They have now been able to display a complete guided-weapon servo-control system.



(1) Igniter unit.
(2) Aux'y cordite charge.
(3) Combustion chamber.
(4) Coupled piston assembly.
(5) Fuel (i.p.n.).
(6) Fuel isolating valve.
(7) Fuel feed line.
(8) Gas feed to pistons.
(9) W/m coolant tank.
(10) Coolant atomizer.
(11) Shear disc.
(12) Filter.
(13) Gas feed to 14.
(14) Turbo-alternator.
(15) Coolant isolating valve.

Illustrated above is the I.P.N. power pack developed by Armstrong Whitworth and described on p. 444. It drives a D.H. turbo-alternator and is used in a British guided weapon.

As a diagram (p. 447) shows, the unit included a pneumatic system fed by high-pressure gas stored in six cylindrical bottles. This gas pressure was led to four bottles of hydraulic fluid and two auxiliary bottles, the six cylinders being charged at an external connection provided with twin shut-off cocks enabling the system to be topped-up as two separate groups, if necessary. The hydraulic bottles, initially full of oil, acted as one-shot pumps during the flight of the weapon. The gas fed to the auxiliary system was piped to a starter valve, and thence taken forward to equipment mounted remotely from the gas bottles.

From the accumulators the hydraulic fluid was fed to an overbalance valve, which prevented any gradual loss of oil, and also protected the accumulators from transient peak pressures which might occur during ground testing. When the system was energized this valve snapped open and admitted the oil through a filter and a pair of ring pipes to the four valve actuators. At the same time fluid was passed to an unlock valve—similar to the starter valves in the pneumatic system—which retracted the control-lock pistons to free the controls; for ground-testing, a manual by-pass valve permitted the fin servos to be freely operated. Other tappings from the hydraulic-supply filter could be taken elsewhere in the weapon, or to a pressure gauge for telemetering. All four actuators exhausted into a common pipe which terminated at the surface of the control ring and vented overboard from the ring connections; an additional pipe served the transducer vents.

The servo system was governed by the autopilot signals, which were amplified and fed to the valve actuators. The latter contained fixed and variable hydraulic resistances, the latter being controlled by the input signals via an electro-mechanical transducer. The pressure-difference between the fixed and variable resistances was used to position a slide valve which controlled the flow of oil to each of the four control actuators mounted on the control-surface shafts. The loop was completed by a feed-back to the auto-pilot of a signal from an inductance pick-off within each control shaft.

Well known as manufacturers of seamless tube for rocket-motor or missile body applications, **Chesterfields** displayed two excellent specimens of cold-drawn steel tube for such purposes. One, measuring 17in in diameter with a wall-thickness of 0.104in, was a section of body for the Gassiot (I.G.Y. upper-atmosphere research) vehicle. The other, for a rocket-motor tube, was in alloy steel 0.070in thick, with a diameter of 10in. (Also on view were a pair of experimental gas bottles in titanium alloy.)

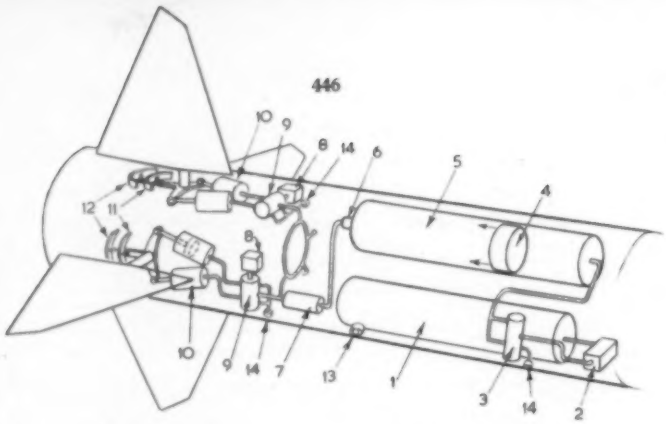
de Havilland Propellers Although this company's Firestreak, the air-to-air weapon of the R.A.F. and Royal Navy, was very much in evidence at the 1957 S.B.A.C. display, it is still a little known fact that de Havilland Propellers have developed and manufactured almost every part of this weapon system and are also supplying numerous accessories to other companies. This year they were allowed to show several of these accessories for the first time (although many of the items were not quite representative of current production practice).

Also on view was a Firestreak launching shoe, a 5ft assembly of anodized light-alloy sections with a single attachment-lug and twin ball locating units which register in a bomb slip, pylon or an aircraft wing tip. The weapon is mounted by twin sliding rails which locate in slots on either side of the inside of the shoe. Clearly the shoe must provide facilities for supplying electric power and hot and cold air to enable the weapon to "warm up" before firing.

One of de Havilland Propellers' principal developments in the G.W. field has been the evolution of a series of turbo-alternators and missile power units. Their work began several years ago when they took over a small and fairly simple R.A.E. h.f. power unit, but this required considerable development in order to clear it to required standard as a prime mover for advanced weapons. Regulating methods had to be devised for controlling frequency with extreme accuracy, and it is of interest to report that the company are now in production with frequency-control units devoid of moving parts.

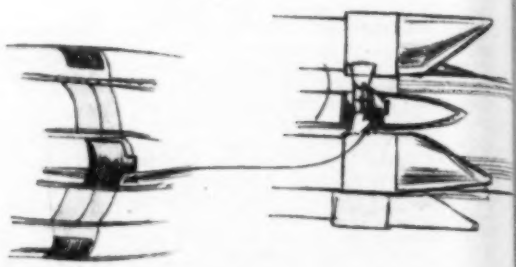
Among the methods of energizing power units which de Havilland have investigated are air, oil, cordite, iso-propyl nitrate and H.T.P. Two of these methods are discussed in the section dealing with Armstrong Whitworth.

According to the characteristics of the system the control can assume several forms. When the source of energy is cordite a valve system is provided to discharge surplus gas overboard and thus provide the alternator with a constant supply of power. Alternatively, all power developed by the burning charge may be fed into a



(1) High-pressure gas cylinder.
(2) Pressure reducing valve.
(3) Starting valve.
(4) Free piston.
(5) Oil recuperator.
(6) Bursting disc.
(7) Filter.
(8) Relays.
(9) Servo valves.
(10) Actuating cylinders.
(11) Telemetering potentiometer.
(12) Feed-back potentiometer.
(13) Charging valve.
(14) Overboard dump.

Described in the text under "M.o.S." on a later page, the CTV-5 moving-wing servo is illustrated in the diagram above.



The sketches on the right show boost mountings on the English Electric Thunderbird. The rear lugs are heavy L-shaped anchorages, and the forward attachments lie under hinged covers in the control fairings.

ON THE GROUND . . .

Guided Weapons (continued)

single shaft driving both the alternator and a suitable device capable of absorbing surplus power, so that the alternator can absorb any fraction of the total power input. Another method is to employ a throttle, but this becomes difficult when using a "dirty" propellant such as cordite.

When using hydraulic oil as the driving medium it is possible to have a simple throttle, and D.H. have devised a design with extreme sensitivity. When very small power is required the pressure-drop imposed on the oil would cause the latter to get very hot, and so for fine metering at minimum power the capacity of the motor itself is varied.

It is common practice to drive two types of power supply—electric plus hydraulic—from a single shaft, or to have two alternators, operating at different frequencies, in tandem. For test work it is useful to have a continuously rated machine, driven by oil or from a constant-speed shaft.

A photograph illustrates a range of D.H. Propellers' missile alternators. The vast majority of British test and production guided weapons use this company's alternators, and D.H. have thereby acquired massive experience. Some of our weapons impose very peculiar electrical loads, and D.H. have evolved a technique for electronically controlling the waveform and filtering out almost all distortion.

The following accessories were on display: *Power unit.* A single-stage axial turbine was mounted on the rotor shaft of an alternator, the latter being surrounded by a stack of condensers. The latter were potted in plastic, and D.H. have potted rectifiers and thereby—they say—improved their rating. A rotary switch above the power unit served to programme events. Incidentally, the turbine is made as large as the weapon size allows, to improve efficiency; for the future, however, very tiny wheels may be used, turning at extremely high r.p.m.

Power electronics. This unit had a cast frame filling the Firestreak cross-section, retained by four transverse bolts. Nine "boxes" were mounted thereon, some of them being potted; other details included small-diameter stainless-steel pipes, apparently for cooling air, held by soldered end-plates bolted to the frame, and tight binding of all wire looms to resist the high launching acceleration.

Rate-gyro. Obviously the Firestreak is roll-stabilized, but a rate-gyro alone could not position-stabilize. Housed in a sheet-covered box were three gyros, driven electrically and fed with air by stainless intake tubes.

Air bottle. Precision welded from steel sheet, this unit was of toroidal form, roughly 9in diameter with a 9in parallel-sided section, and a hole in the middle—presumably to fit over the rocket-motor exhaust tube. Four mounting bolts were provided at one end. Storage pressure must be very great since the air must drive the alternator and—because a twin starting valve was exhibited—some other task also. There was no sign of any hydraulic equipment on view, and one is led to the conclusion that Firestreak's controls are actuated by pneumatic rams. If extreme pressure were applied to either side of a piston-type jack the latter could be held very firmly, thus making the control irreversible.

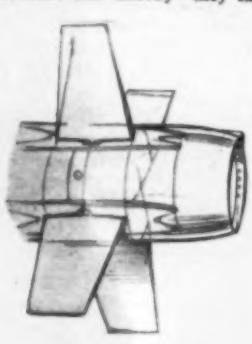
Alternators. Among the range on view (picture, p. 448) was a hydraulically driven unit and the machine associated with the Armstrong Whitworth power pack (*q.v.*). Also on show was a very neat alternator unit with an electronic controller at one end, the turbine in the middle and the alternator at the other end. As is generally preferred, the unit was strap-mounted.

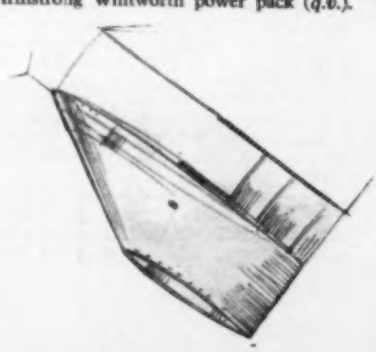
It was natural that **Dowty** should be brought into the guided-weapon picture at an early stage, and this is the first time the company have been able to show what they have achieved in this challenging field. Their exhibits covered a wide range of devices, all carried on board the weapon.

One of their hydraulic pumps delivers no less than 2 cu in fluid per second at 3,000 lb/sq in, though it weighs but 12.8 oz and measures less than 2in long; of the fixed-displacement type, it operates at 24,000 r.p.m. A much larger pump was designed for use in big anti-aircraft weapons. At 8,000 r.p.m. it can deliver 55 cu in/sec at 3,000 lb/sq in, with inlet pressure of 10 lb sq/in; the weight is 7½ lb and the minimum life 30 hr at 150 deg C. Another rotary machine by Dowty is a hydraulic motor with an output of 6 b.h.p. at 4,000 r.p.m. Of the 10-cylinder axial pattern, it takes 3.4 gal/min of oil at 3,500 lb/sq in and has a weight of only 3.5 lb.

Dowty makes several varieties of hydraulic accumulator for missile applications. Both high-pressure and low-pressure versions are in production, each type being a simple and efficient piston-type unit. The h-p. assemblies weigh 10.6 lb and contain (oil plus gas) 311 cu in; the standard l-p. bottles weigh 7.09 lb and contain 287 cu in. A related device is a "constant-pressure" reservoir, which comprises a large-diameter piston loaded through a smaller piston connected to the h-p. circuit, eliminating the need for air or gas inflation.

One of the most important Dowty missile accessories is a single-stage servo





Two missiles seen at Farnborough for the first time were the Vickers-Armstrongs Type 888 (Red Dean) and the Short surface-to-air guidance-research vehicle. The 888 rear end is shown at far left, the blunt control trailing-edges being notable; the Short missile has "low-speed," wrapped-sheet, pivoting wings arranged in a cruciform.

valve, designed primarily for controlling the weapon's control fins. The valve amplifies a small signal from the guidance system and converts it into a powerful hydraulic signal to the control actuators. The push-pull input signal may vary between 0 and 10 mA, and the output is 9 cu in/sec with a 2,000 lb/sq in pressure drop. The system pressure may be as high as 4,000 lb/sq in and the frequency response exceeds 100 cyc/sec. The whole valve weighs 1.88 lb. A related unit, performing a similar function but with a greater output, is a two-stage servo valve weighing 4.43 lb. With other characteristics similar to those of the single-stage assembly, the output is up to a maximum of 45 cu in/sec.

Most of the guided-weapon accessories by **Dunlop's** Aviation Division are components for use in pneumatic systems. A typical example of their techniques was provided by an air bottle, in the top of which is mounted a pressure-reducing valve while the body of the latter contains a miniature solenoid-operated control valve. Naturally, as the bottle discharges its pressure falls, and the reducing valve has to maintain constant supply at a constant pressure, even when the bottle pressure has fallen almost exactly to the same level.

The solenoid-operated valve operates at a nominal 24 V.D.C., and requires a 0.25-sec impulse to initiate operation. After discharge of the bottle the valve reseats, so that the bottle need only be recharged for use a second time. Two solenoid valves are mounted in a twin starter valve manufactured for de Havilland Propellers, and clearly used to trigger off two distinct air supplies in Firestreak. Machined from a single metal block, the body measures about 5in by 2in by 1in and also incorporates a pair of reducing valves.

Elliott Brothers Few companies anywhere in the world are conducting so many missile firings for pure research, since Elliott are sub-contractors to the M.o.S. for virtually all the electronics in the much-used GPV, and have their own team at Aberporth.

An outdoor exhibit showed a sectioned GPV (see Short and Harland) complete with its homing head. The "target" was a conical aerial emitting radar pulses of the type reflected by a target to give semi-active homing. A bent spinner in the centre of the missile "dish" rotated to give conical scanning, the pulses being modulated and the target direction being denoted by the phase of the resulting received signal. This signal was fed back to an amplifier and used to drive gyros which, in turn, pointed the parabolic scanner dish at the target. This set up an error signal which, upon being amplified, was suitable for feeding back to the main steering gear of the vehicle.

Target range was obtained by blade aerials on the sides of the fore-body, which picked up pulses from a second ground radar (synchronized with the pulses from the "lamp" set illuminating the target, but of different frequency). The time-difference between reception of the two sets of pulses was used to "gate" the missile radar, and prevent the latter from responding to any signals except those emanating from the individual target selected. A series of photographs showed a GPV actually striking a metal-sphere target suspended beneath a balloon.

Elliott are also, of course, a major manufacturer of digital and analogue computers, and use both types of equipment in analysis of missile behaviour at Aberporth and Woomera. Data analysis is carried out at the company laboratory at Boreham Wood, Herts, and test programmes are also in hand for all the principal members of the British G.W. industry.

English Electric This industrial giant is one of the few firms—if not the only firm—in the world capable of developing and making a complete advanced weapon system without outside help. Thunderbird, their rocket-propelled anti-aircraft weapon, is in bulk production for the Army, and on September 3 an order was also placed by the R.A.F.

It is an extremely good, compact, rugged and effective missile, and apparently makes up in altitude what it loses to ramjet weapons in range. First seen at the S.B.A.C. show, it is a semi-active homing weapon, with cruciform wings and rear controls. English Electric stated last week that:

"Thunderbird is one of a family of weapon systems being developed by English Electric and several hundred missiles have been fired at Aberporth (South Wales) and Woomera (Australia). The system embraces ground radars, launchers, fire control units and associated test equipment as well as the actual missile. The missile has been engineered for progressive development and, as a result, it can be modified to meet the ever advancing nature of the air threat by substituting new and improved main sub-assemblies without the need to re-design the entire missile."

Various examples of small G.W. test instruments were exhibited by **Graseby**, including equipment for producing signals suitable for telemetering. For the transmission of angle of incidence, the Type GW.4 unit is used, with twin delta yaw-sensitive vanes governing twin potentiometers. Typical angular ranges are ±5 deg and ±12 deg. Another pair of exhibits was concerned in the telemetering of acceleration: the GW.6 control transducer, capable of loading up to ±60 g, and the GW.5 and 8 acceleration recorders with limits of ±2.5 g and ±100 g.

Described as fully as security allows in our issue of August 16, **Fairey Aviation's** Fireflash was much in evidence at Farnborough. Photographs showed that it is stored in two groups: Group I, comprising all explosive portions (warhead, fuse and boost motors) and Group II, comprising guidance gear, wings and controls. Rounds are delivered in shockproof and climate-sealed containers and assembled, tested and checked as Groups I and II, after which the sections are put together on the loading trolley and wheeled out to the aircraft.

Fairey are also European agents for the Australian Department of Aircraft Production who manufacture the Jindivik radio-controlled target. Much used on the Woomera range, and shot at by both Fireflash and Firestreak, Jindivik has been exported to Sweden and is a very fine vehicle. An example was statically exhibited.

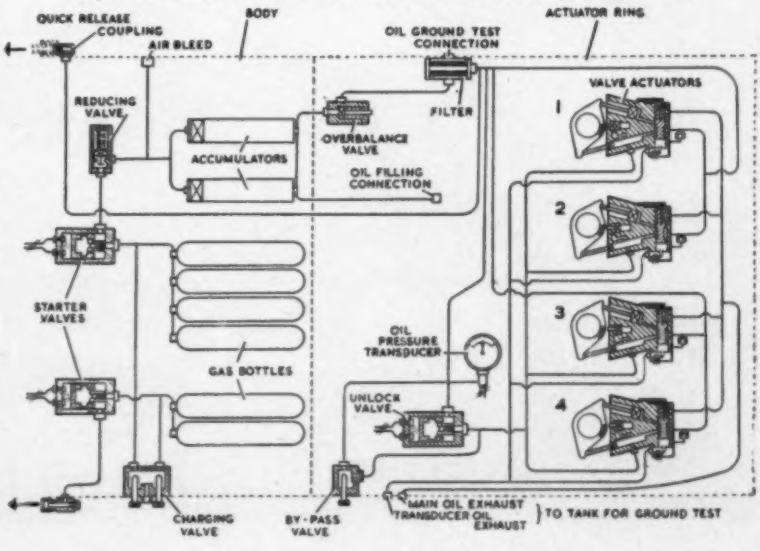
Hairlok manufacture transport and storage containers for the Firestreak. Exhibited was a version produced for the Royal Navy, incorporating a hermetically sealed envelope and cushioning to resist free-fall up to 24in with accelerations up to 25 g.

One of the chief exponents of the art of powered flying controls, and referred to in that section, **H. M. Hobson** are also busily engaged in missile controls. They were the sub-contractors for this part of the Short/M.o.S. GPV test vehicle, and evolved for this application a basic servo which is now also used in certain other vehicles, including the moving-wing CTVs (see paragraph on the M.o.S.). An outdoor working system demonstrated the characteristics of the system, data for which are: stall torque, 1,750 lb-in at 2,000 lb/sq in; load inertia, 60 lb-in ; design operating pressure, 2,000 to 3,000 lb/sq in; maximum response speed, 750 to 900 deg/sec; hydraulic horse-power, 3.

Typical of the small **Hymatic** valves suitable for guided-weapon applications is the starter valve, Type SV 17. This is a valve which, after retaining a pressure up to 4,000 lb/sq in for an indefinite period, opens the pressure for a one-shot operation. It comprises a metal-foil diaphragm to seal the fluid line completely and a Bakelite tube containing gunpowder and an electric fuse. When the latter is energized the charge ruptures the disc and allows the store of pressure to discharge at up to 31 lb/min with a pressure drop of not over 180 lb/sq in. Typical uses include fuel-dumping and starting.

A valve typical of a different species is the solenoid valve MD 23, in which a main valve is operated by system pressure released by a pilot valve actuated by a D.C. solenoid. Weighing 1.5 lb it can control missile supplies at up to 4,000 lb/sq in, and passes a flow of up to 72.5 lb/min with a pressure drop (at 50 cu ft/min from

A system diagram of the British Messier servo-control, described on page 445.



ON THE GROUND . . .

Guided Weapons (continued)

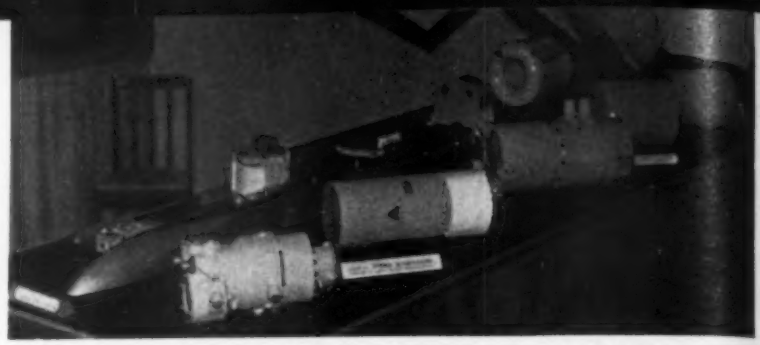
an 800 lb/sq in source) of only 10 lb sq/in.

McMichael One of the most-used British telemetry equipments is this company's Type X1763, consisting of the X1760 transmitter, X1761A oscillator, X9618 voltage unit, and X7770 or 1762 junction box. Up to six sets of data may be transmitted continuously and simultaneously. This is achieved by employing a carrier wave (90 to 95 Mc/s) amplitude-modulated with up to six audio tones, the central frequencies of which are spaced between 550 and 15,000 c/s; the intelligence is then transmitted by varying the frequency of each tone about its mean value.

M.L. An exhibit in the outdoor equipment park revealed that M.L. Aviation, Ltd., are the manufacturers of the complete launching trolley for the Bloodhound surface-to-air weapon.

As owners of the ground on which the S.B.A.C. show is held, and customers and sponsors of virtually all our guided weapons, the **Ministry of Supply** can choose from an immense variety of new developments in selecting exhibits. Their display items were described on August 30, but the following text serves to explain the CTV-5 moving-wing servo display (drawing, page 446), which had a geometry apparently similar to that of Bloodhound:—

"This exhibit is a typical example of equipment designed and manufactured in R.A.E. for use as a research tool in a test vehicle. The servo ring contains four 10 h.p. electro-hydraulic servos operating at oil pressures up to 4,500 lb/sq in, each of which operates a wing surface. The servos can be operated independently and the design provides for the wing surfaces to be easily changed to facilitate the use of different wing forms. The oil supply system can either be of the total loss system shown or a circulating pump system for short and long flight durations respectively. The servos are of the single stage type and are noteworthy in respect of the high working pressures and the high power output obtained from a single stage of hydraulic amplification. Principal data: stall torque, 3,500 lb-in; load inertia, 200 lb-in^2; design operating pressure, 3,800 to 4,500 lb/sq in; maximum speed of response, 1,200 deg/sec."



A wide range of accessories—chiefly turbo-alternators—on the D.H. Propellers stand.

Muirhead Most important of the miniature guided-weapon products by Muirhead and company, the "size 8" units have been widely accepted, and were originally designed to M.o.S. requirements. They are the smallest of a wide range of 400 c/s synchro units manufactured to MIL specifications. One of the new miniature units is the control transmitter, Type 26V08CX4(B); weighing 2 oz it measures 0.75in diameter by 1.343in long and has a peak error of 10 min of arc. The related control transformer is mechanically very similar and has the same angular accuracy.

Mullard have made the following statement regarding their work in connection with the de Havilland Propellers' Firestreak (they were not allowed to exhibit any "hardware").

"An essential part of the recently announced Firestreak air-to-air guided weapon, developed by de Havilland Propellers, Ltd., is an exceptionally sensitive infra-red photo-cell which is an essential part of the Firestreak detector eye. By detecting the heat radiated from the target this eye enables the weapon to home on its objective. Made to an initial target specification of the Royal Radar Establishment, this cell has been the subject of intensive research by Mullard to bring it to a high state of perfection. Certain other items of associated equipment have also been developed by Mullard for the Firestreak. Some idea of the sensitivity of infra-red cells may be gauged from published figures which show that the heat from an electric fire can be detected some miles away by one of these devices.

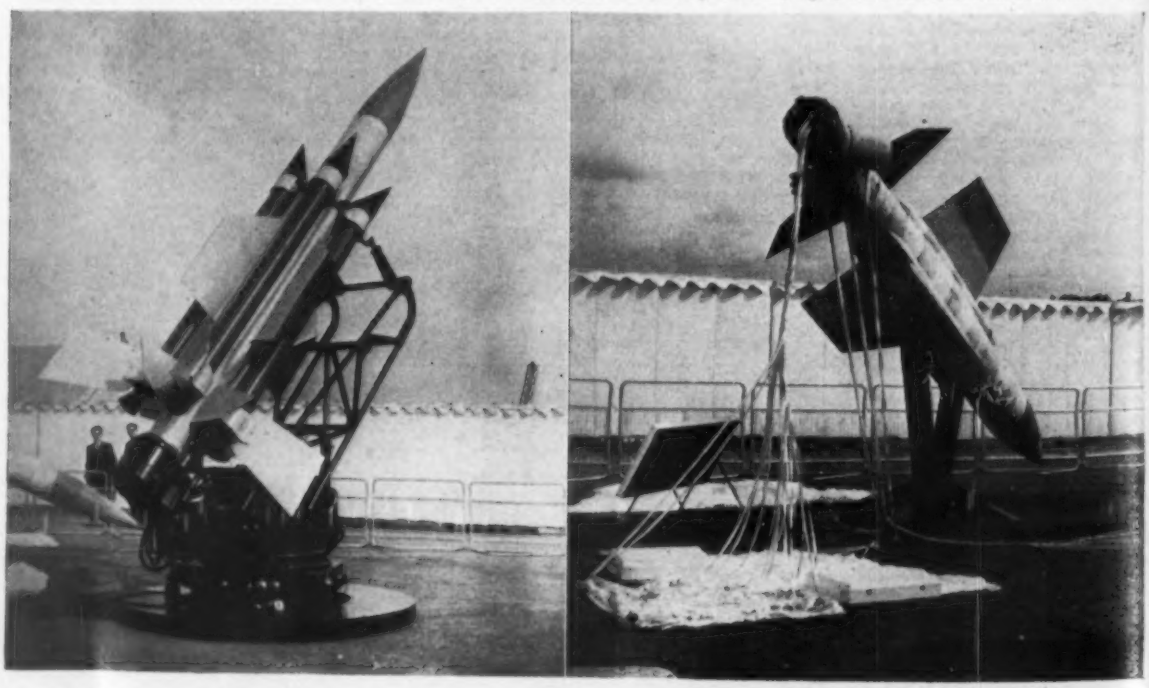
"Another major contribution of the company for the defence programme is the supply of specially developed sub-miniature valves. Mullard have developed these highly specialized valves, which are made in large numbers for weapon control systems, particularly inside the guided weapons themselves. These valves, designed for efficient operation under the most exacting conditions, represent the highest standards of quality and reliability attainable, and are the outcome of continued and intensive research and development work over many years."

Illustrated on page 449, the power pack by **The Plessey Company** for guided weapons and test vehicles was one of the most interesting new developments to be seen. The following is the security-cleared statement on the unit:

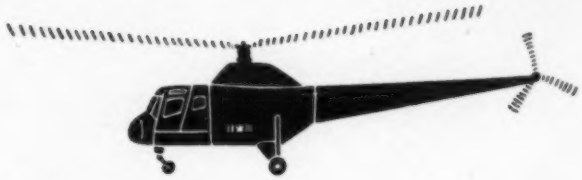
"The power pack has been specifically developed for use in guided weapons and G.W. test vehicles for re-charging of servo hydraulic accumulators.

"It is a turbine driven unit, using isopropyl nitrate monofuel, combustion being initiated by a small electrically fired cart-

Two superb missiles by English Electric: left, the complete Thunderbird on its firing launcher; right, the recoverable vehicle (twice fired).



WESTLAND

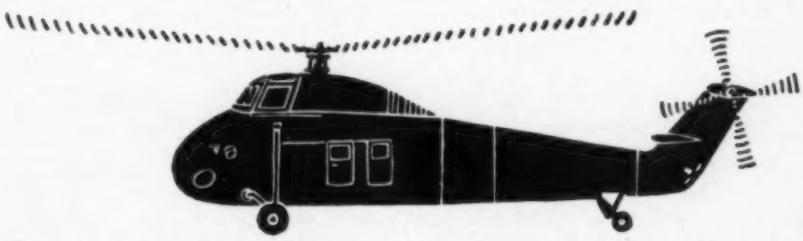


WIDGEON

Carries four passengers or ½ ton of freight

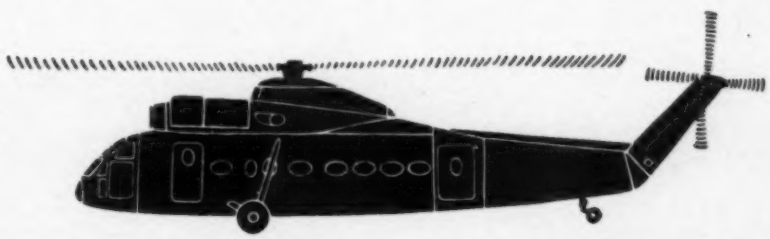
WHIRLWIND

Carries eight passengers or 1 ton of freight



WESSEX

Carries twelve passengers or 2½ tons of freight

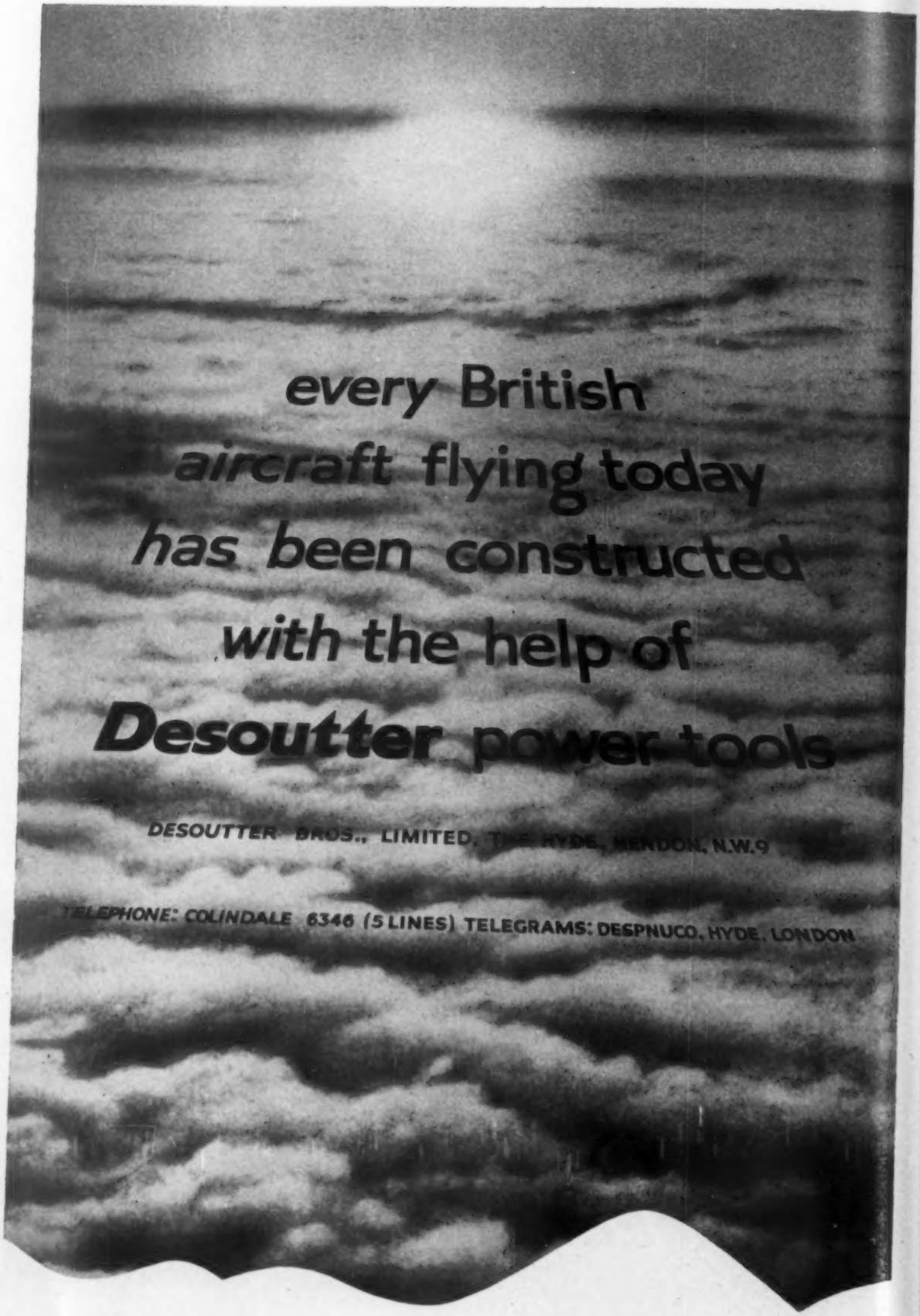


WESTMINSTER

Carries forty-two passengers or 7 tons of freight

HELICOPTERS
MEET ALL NEEDS

WESTLAND AIRCRAFT LIMITED YEOVIL ENGLAND


every British
aircraft flying today
has been constructed
with the help of
Desoutter power tools
DESOUTTER BROS., LIMITED,
HYDE, HENDON, N.W.9
TELEPHONE: COLINDALE 6346 (5 LINES) TELEGRAMS: DESPNUCO, HYDE, LONDON
CRC 41

ON THE GROUND . . .

Guided Weapons (continued)

ridge. The power pack may be assembled into a missile and left in store in a safe condition.

"The hydraulic pump is driven by the turbine through a speed-reduction gear box. It is similar to the Type Series 10 pump also on display. A fuel-control valve is incorporated, sensing change in hydraulic loading, it varies the fuel flow to the combustion chamber, thus controlling the power output of the turbine.

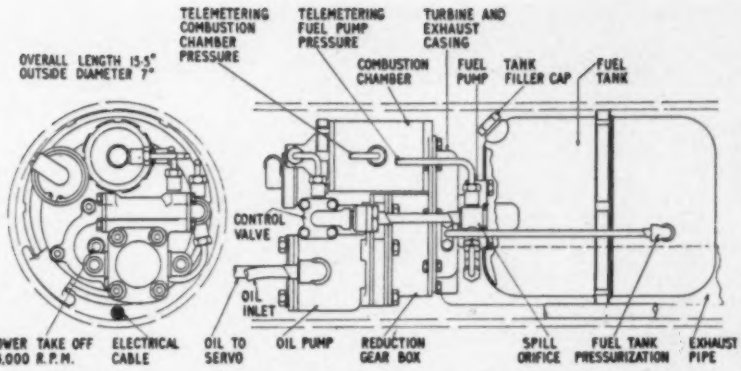
"The overall speed range is governed to within 5 per cent both on and off load. Provision is also made for test running of the unit, using an external air supply, up to full hydraulic pressure, with the unit fully charged with fuel."

The power pack exhibited was rated at 20 hydraulic horse-power at up to 4,500 lb/sq in, and had a weight of 16 lb. In the development stage are packs with outputs ranging up to 7.5 kW and with combined hydraulic and electrical output.

Sankeys of Bilston Prominent on this firm's stand was the big regeneratively cooled chamber for a 50,000 lb-thrust liquid-propellant rocket motor first exhibited by the M.o.S. about a year ago. It is precision welded in heat-resistant steel, to R.A.E. requirements.

Short Brothers and Harland, of Belfast, are likely to make a very large number of the simple device described as "a multi-purpose surface-to-air missile" (it has no name or published designation). Officially described as being used for research into guidance systems, it seems to have a solid tandem boost with cruciform fins and a cylindrical body with an ogive nose of subsonic—or just supersonic—profile. On the body are four superimposed fairings which produce a substantially square cross-section in the vicinity of the cruciform wings, which are pivoted to provide flight control. The wing trailing edges overhang the body, and the surfaces themselves are wrapped from sheet. Existing components were used wherever possible, and development of the vehicle has been extraordinarily rapid.

One of the company's chief G.W. programmes has been the design and manufacture of GPV, a multi-purpose test and research vehicle which has already been fired in large numbers and is bringing in great quantities of data. When Short began this work they took over the RTV-2, which in 1952 was the standard round for this purpose. Although the GPV looks extremely similar to the RTV-2 it is in fact wholly redesigned, and has completely new interior layout and systems. It has a fixed cruciform of wings, high aspect-ratio rear controls operated by electro-hydraulic servos, four pairs of wrap-round boosts and an internal liquid-propellant motor.



A diagram of the Plessey missile power pack, discussed in the accompanying text.

On the company stand, Short displayed details of the GPV fuel system. Six metal bottles hold H.T.P. and a seventh is filled with kerosine; the starter charge bursts the sealing disc and nitrogen pressure is applied to free pistons, running on Dowty seals inside each cylinder, which expel the propellants through a catalyst gauze and into the chamber. As an alternative to this system the GPV rounds can be fitted with a solid sustainer.

Vactric This company manufacture a wide range of small A.C. and D.C. machines for both aircraft and missile applications, the majority of the A.C. units working in 400 c/s two-phase systems. One of the recent Size 11 motors has a synchronous speed of 8,000 r.p.m., but develops nearly full torque at much lower speeds so that loads may be permanently coupled. For use against M.o.S. spec. No. EL.1789, the unit can be potted and the rotor run in stainless-steel bearings. Like most Vactric rotating machines it can be fitted with a precision gear-head with a reduction of up to 360,000:1.

Long renowned for their miniature accumulators, **Venner** displayed a variety of missile batteries. Several of these are supplied dry and filled with electrolyte from a polythene ampoule; by this means the shelf-life is indefinite. Several patterns are dry-charged, so that injection of the fluid results in a charged cell.

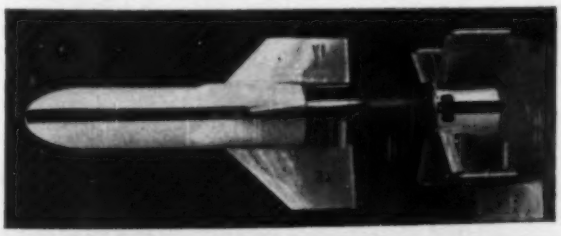
Much used are the SZ 6/12 series, with a double series/parallel output and flat voltage characteristics up to 40 deg C. Ten cells, moulded in polystyrene, weigh 23 oz, and have a capacity of about 4 amp-hr at 20 A continuous rating. The DGW, apparently used in Fireflash, is a typical silver-zinc cell of 1.5 amp-hr capacity and weighing 1¼ oz, and the CGW provides 0.75 amp-hr for a weight of ¾ oz. A completely sealed resin-pot h.t. unit had terminals at −30 and +20V, weighed 9½ oz and could provide 250 to 300 mA for up to 30 min; it had very flat output characteristics, like the SH.20, as large as a pack of 20 cigarettes, which delivers no less than 125 A for up to 15 min at a nominal 1.5V.

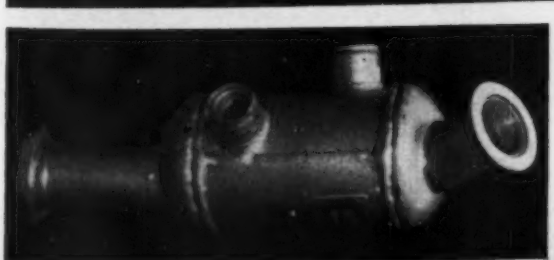
Although their G.W. strength, in personnel, facilities and experience, is very great, **Vickers-Armstrongs (Aircraft)** have not previously been able to say very much about their work in this field. At this S.B.A.C. show they were allowed to exhibit Type 888, a big air-to-air weapon for all-weather use (illustrated last week and subject of a detail on page 446) and also revealed their neat Type 981 anti-armour weapon for infantry use.

Resembling the French and American wire-guided missiles, but smaller, neater and—in production—cheaper than either, Type 981 is illustrated here in a drawing. It is packed in a container from which it is fired by a solid motor, guidance being effected by a simple optical controller through which the user sights the missile's tracking flares. The guidance signals are passed through the cable seen in the drawing and presumably through thin wires to the missile. Total system weight, including case, is 40 lb.

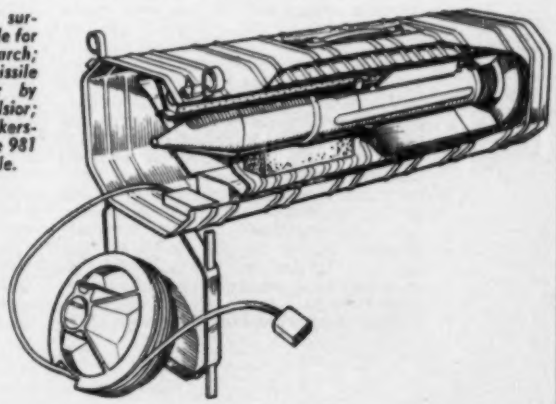
Vinten Although not strictly engaged in the G.W. business as such, this company make a range of cameras without which our missile programmes would be very severely handicapped. Some of these cameras are very large, but one of the most important is the new, but widely used, 16mm high-speed cine camera. (The well-known rear view of a Firestreak just departing from its launcher was originally a frame on colour film taken by one of these cameras.)

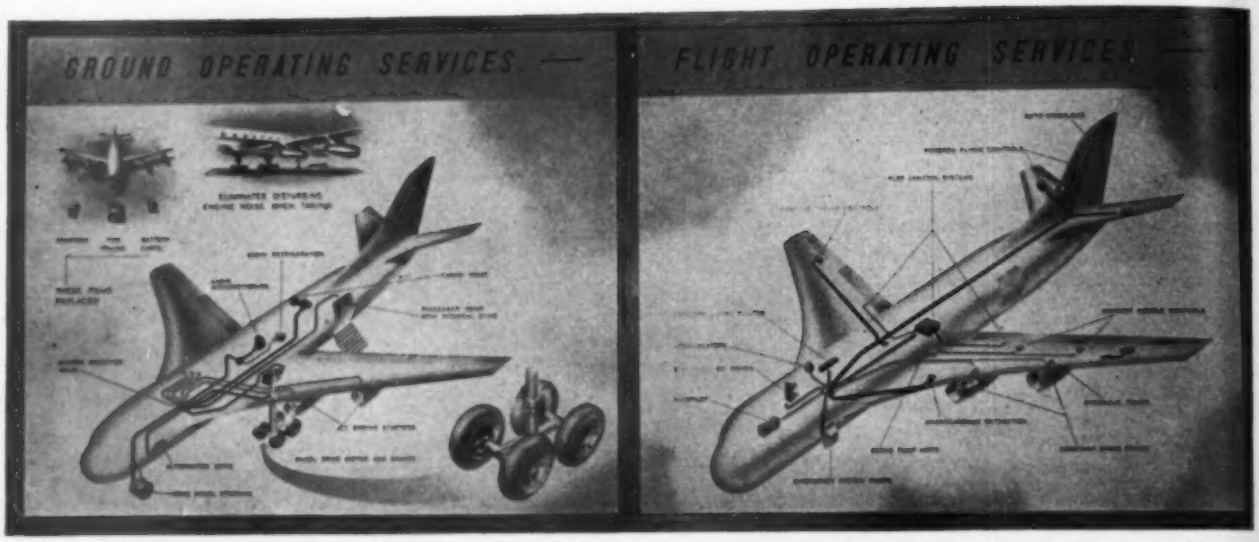
The 16mm H.S.C. camera has been designed to meet very severe requirements. In addition to several other arduous factors, it can withstand high accelerations, high temperature and severe vibration for prolonged periods, yet the whole equipment weighs but 5.7 lb and occupies 90 cu in, both figures assuming the addition of a cassette for 50ft of film. Standard speed is 100 frames per second.





Left, the Short surface-to-air missile for guidance research; left, below, a missile heat exchanger by Marston Excelsior; right, the Vickers-Armstrongs Type 981 infantry missile.





This panel, on Sperry's stand, showed some of the uses to which an integrated hydraulic system could be applied in the air and on the ground.

ON THE GROUND

HYDRAULICS

SHOWN on the **Sperry Gyroscope Co.** stand near the main entrance to the indoor exhibition were the two pictures illustrated in the photograph on this page. No components, no sales literature, not even the manufacturer's name appeared anywhere near this exhibit, and apart from a vague resemblance to a Boeing 707, the "ghosted" aircraft does not seem to represent any possible application that Sperry might be trying to convey.

How much interest this stand attracted during the week is hard to gauge, but this unusual approach, and the content of the pictures, appeared to involve the firm's representatives in several deep discussions. In the company's words, the display was calculated to make people think; and because Sperry had done the thinking beforehand, they naturally have something to offer—a subtle and imaginative approach.

Retracing the thinking along which their customers' thoughts are directed, it becomes obvious that many fewer vehicles must be required for apron servicing of aircraft if turnround times are to be reduced. And if service trucks are not to be used, the power supplies for starting, towing, air conditioning and so on must be carried in the aircraft. There will be some weight penalty, of course, but this can be reduced to a minimum if the auxiliary power unit is carefully chosen and the complete system is integrated to the maximum possible extent. Because hydraulics are already widely used in every aircraft, Sperry's philosophy is that the same power source should be put to use for operating air stairs, starting the engines, cabin conditioning and refrigerating, constant speed drives, operating exhaust control nozzles (temperature limitations must be guarded against), autopilot and autostabilizer operation and driving the wheels for engine-off taxying. This latter application has been frequently proposed during the past twelve months, but not so far introduced as hardware. The integrated comprehensive hydraulic system appears to be a better way of doing this than by clip-on units for the wheels.

The conclusion is that a good many new applications for hydraulic pumps will be found—and Sperry are to build Vickers (Detroit) hydraulic pumps under licence and are studying their applications to these systems.

The major share of the new hydraulic pumps at the show was to be found on the **Integral** stand. This well-known Wolverhampton firm were showing six new hydraulic pumps, among them the constant-speed motor and pump cartridge of the Hobson constant-speed drive. Design interchange this year has also been carried on with the New York Air Brake Co.

Among the new pumps from Integral which result from this collaboration is the Type 236. It is claimed to have an exceptionally good power to weight ratio, and by using a titanium casing, a further saving of 1 lb can be effected. A nine-axial-piston type with poppet valves and ported inlet, which gives an infinitely variable delivery at a true constant pressure, it has an improved fully automatic servo control which allows variable speed of drive with constant pressure and delivery. It is completely reversible and will operate at pressures down to 6in Hg absolute. A particularly attractive feature is the absolutely vertical fall-off in delivery, allowing the maximum use to be made of the top end of the performance range. The delivery is ten to 15 gal/min at 4,000 to 6,000 r.p.m.

A basically similar, but larger, pump is the Type 234 and a new all-British high speed pump is the Type 230. This is a variable delivery, swashplate pump with an initial gear stage and automatic off-loading by a pressure sensitive servo mechanism. The initial gear stage provides a positive flow of fluid to the second-stage cylinders and enables free pistons to be used; should a piston seize, it will remain clear of the swashplate and not prevent the pump functioning. Other features are cooling when running off load, by by-passing the gear stage output back to the system reservoir, and a servo control of the swashplate giving a narrow pressure band between full flow and zero delivery.

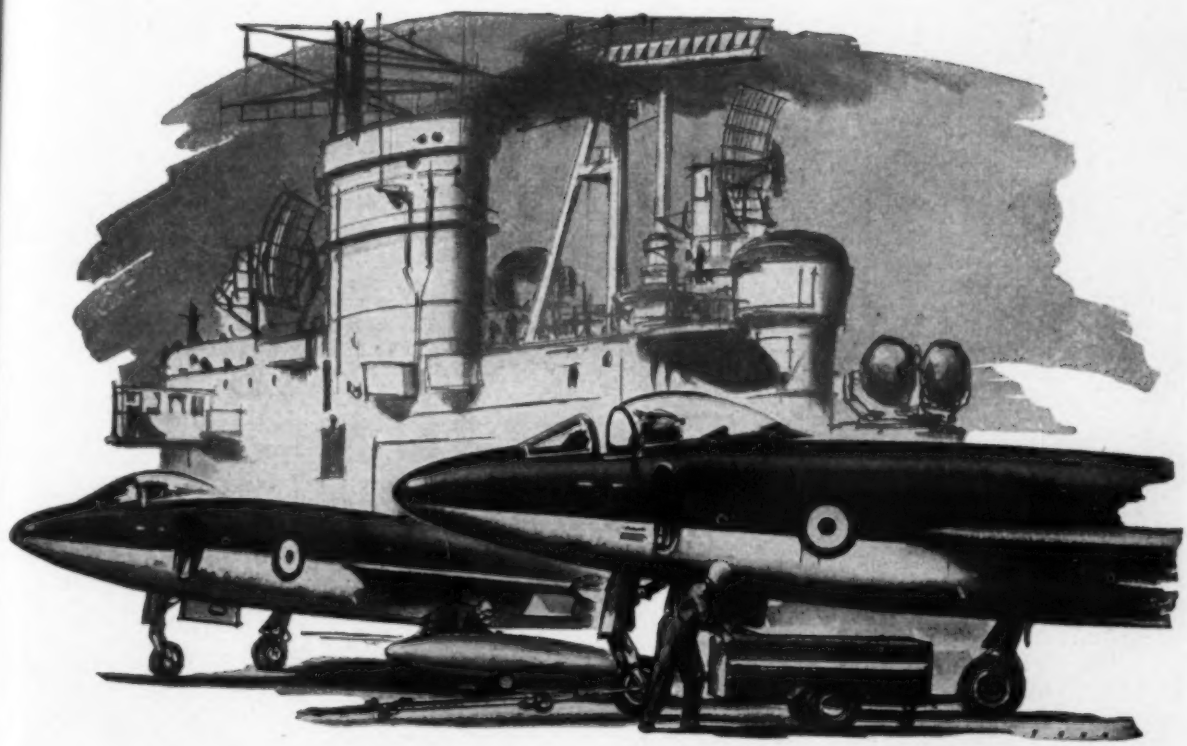
Another new exhibit in the hydraulics section was shown by **Electro-Hydraulics, Ltd.** This is a reservoir in impregnated glassfibre and is described in the section on New Materials.

INDEPENDENT NAVIGATION SYSTEMS

THE sight on the **English Electric** stand of a Minneapolis-Honeywell HIG.6 low-drift gyro mounted in the company's own single-axis test table prompted a quick investigation of British work on inertial navigation systems. Both Honeywell and Kearfott gyros are involved; and no British company appears to be engaged in manufacturing gyros of this calibre. The HIG.6 seemed to be taking about an hour to spin up, and the table was set to investigate its drift rate under 1g conditions. Earth's rotation could be used for calibration purposes and the table could be aligned as an equatorial mount. The HIG.6 required a special electrical supply with a very low harmonic quality and its temperature had to be maintained within 0.1 deg C.

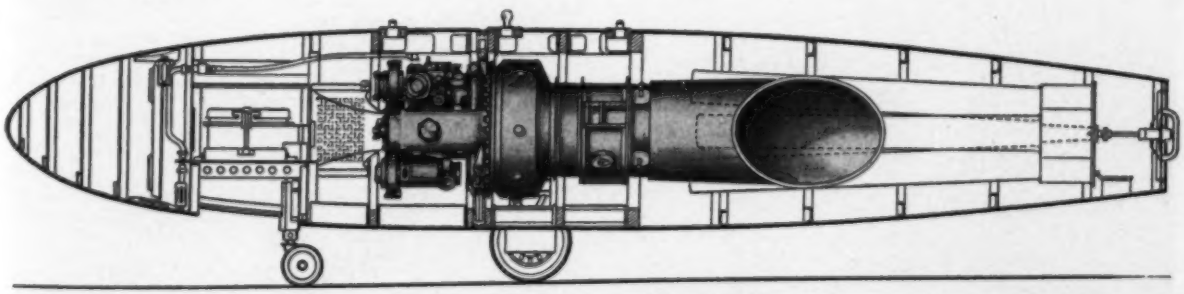
S. G. Brown, Ltd., also showed a gyro test table which they stated was sufficiently accurate for testing the low-drift gyros required for inertial systems. But the most significant exhibits were the polar axis table and the servoed gimbal table exhibited by **Graseby Instruments, Ltd.** These have been specially made to calibrate and evaluate gyros suitable for inertial systems and both British and American companies are interested in them. Both are more accurate and versatile than anything of this kind yet produced and all necessary tests on gyros weighing up to 30 lb can be carried out without removing the gyro at any stage. Special optical and photo-electric measuring facilities are built in; and the polar axis table carries both Weston and Plessey plugs to suit Kearfott and Sperry gyros. An air supply for either air-driven or air-bearing gyros, as well as 24 slip rings, are fitted, together with a synchronous motor drive to rotate the table at earth's rate $\times 1$, $\times 10$ or $\times 40$. **R. E. Pullin and Co., Ltd.**, were exhibiting Kearfott servo components.

Another navigation device was the airborne automatic plotting table on the **Louis Newmark** stand. This consists of a tracer moving in x and y co-ordinates under a marked glass plate. The tracer is moved around according to compass heading and aircraft speed and wind velocity inputs.



Hand starting a jet . . .

not the main engine but the Palouste air-bleed jet engine which powers the newest starter pods and trolleys for high-performance aircraft jet engines. The Blackburn Palouste 500 is a single-shaft, 2-stage, axial turbine with an annular combustion chamber and air bleed, providing 2.65 lb./sec. air at 56 p.s.i.a. Mounted in a ground starter trolley the overall length of the complete equipment is 8′ 11″, width 5′ 3″, height 3′ 7″.



The sectional drawing shows the Blackburn Palouste installed in an air-transportable pod which can be attached to pylons under the aircraft wing. An inbuilt undercarriage enables it to be used for Squadron Service at advanced airfields.

"Palouste"

LOW-PRESSURE AIR STARTERS

Blackburn and General Aircraft Limited. ENGINE DIVISION *43 Berkeley Square. London. W1*

A 89/a

PHOTOGRAPH BY COURTESY OF 'FLIGHT'

DAGENITE AIRCRAFT BATTERIES
chosen for the
VICKERS
VISCOUNT
800
G-AOJA
Dagenite 24-volt 25 Ah. aircraft batteries
ventilated type 12ECM13-VA are initial equipment
on the Vickers Viscount 800 airliner.
Dagenite aircraft batteries are in world-wide
service on many types of aircraft.
Dagenite AIRCRAFT BATTERIES
MADE LIGHT FOR FLIGHT!
PETO & RADFORD, 137 VICTORIA STREET, LONDON SW1 · Tel: TATe Gallery 9212
PR 27

The S. G. Brown Master Reference Gyro, above, and, right, the various units of the Air Data Computer Mk 1 made by Elliott Brothers (London), Ltd.

ON THE GROUND . . .

INSTRUMENTATION

Considerable advances have now been made in blind flying instrumentation, and particularly in two directions—centralized data sources and roller-blind dial presentations. The general considerations underlying these two features were set out in *Flight* for April 12, but the hardware was shown at Farnborough for the first time.

Firstly, it is evident that gyro attitude-references can no longer be provided separately for each of the many systems which require them. Therefore, most of the new aircraft are relying on a master reference gyro system produced by **S. G. Brown, Ltd.** The type exhibited on this company's stand was the A.5, or Mk 1, which has attitude and heading gyros mounted in a servo-operated platform. The vertical gyro is monitored to gravity and the azimuth gyro is monitored to the magnetic fluxgate element of a specially developed compass system designed by **Kelvin Hughes, Ltd.**, and called the Compass System Mk 5. A description of the M.R.G. was given in *Flight* for April 12. The M.R.G. cannot, of course, be toppled.

The other centralized information system is that relating to the immediate surroundings of the aircraft. Again, each system requiring such information used to have its own sensing devices, but it is now planned that a single set of sensing elements should be used, and the signals from them cross-checked, corrected for normal errors and passed to all user-systems.

Elliott Brothers (London), Ltd., showed for the first time their Air Data Computer Mk 1, which constitutes a complete centralized source of aerodynamic data. It is assembled on a unit-construction basis and can be fitted with just the units required for a particular application. A wide choice of outputs is available in either linear or logarithmic form, including height, I.A.S., Mach number, T.A.S., vertical speed, static pressure, pitot-static pressure, ambient temperature, air density and acceleration. The outputs are available either as voltage or synchro signals or as shaft rotations; and up to four separate signals can be provided simultaneously from each output. Pitot-static and static pressure are measured in a two-capsule system by an A.C. pick-off whose signal is amplified and used to operate a motor tacho. Potentiometers provide outputs which are used in the electrical computations. Temperature readings are obtained from a resistance probe temperature unit, suitably corrected and computed. The Air Data Computer operates from a 115 V, three-phase, 400 c/s power supply and has a consumption and weight, dependent on the particular arrangement, of 160-180 W and about 30 lb. A Mk 2 version, now being completed, weighs only half as much.

The Ferranti F.H.7 miniature artificial horizon with wide bar presentation and Kelvin Hughes all-attitude ball slip indicator.

Louis Newmark, Ltd., showed another air data unit which is intended primarily for supplying error signals for an autopilot when these are required for height lock and Mach number—or airspeed—holding. The unit contains a pair of servo-followed logarithmic capsule assemblies driving a set of potentiometers, a computer and three clutched potentiometers. This air data unit adjusts the parameters of an autopilot as a function of height, Mach number and airspeed.

Another air data computer on show was that by Kelvin Hughes. It is generally tied to the Flight Data System which is the new integrated instrument panel. It contains two force-balance systems, for static and pitot-static pressure, giving a linear output. The measurements are fed to correction units which are a combination of mechanical and electrical circuits; and passed to a computer which calculates Mach number. Vertical speed, height and indicated airspeed measurements are also produced and passed to the related tape displays on the instrument panel.

The complete Flight Data System was shown on the **Smiths Group** stand and was also exhibited as a working model on the **M.o.S.** stand. A horizontal two-tape system showed I.A.S. and Mach number together and a similar vertical tape system showed absolute height and vertical speed against a common datum. The roller-blind attitude indicator, previously shown as a plain artificial horizon, now includes a steering dot, for the flight director function, and a ball slip indicator. Next to it is the navigation display which provides heading, I.L.S. localizer and glide-slope and Tacan navigation presentations. The last two are provided with the aid of the roller-blind system while the first is shown approximately in the same way as on a gyro-magnetic compass. The Flight Data System was described in *Flight* for August 16 and is intended for operation in conjunction with the S. G. Brown M.R.G. It requires standard 115 V A.C. power supply and consumes approximately 800 VA.

Both the Kelvin Hughes Flight Data System and the Elliott Air Data Computer have been flight-tested. The Elliott computer can drive either conventional dial instruments or moving tape indicators. The Kelvin Hughes air data computer type X-TR.1, was also shown as a separate unit.

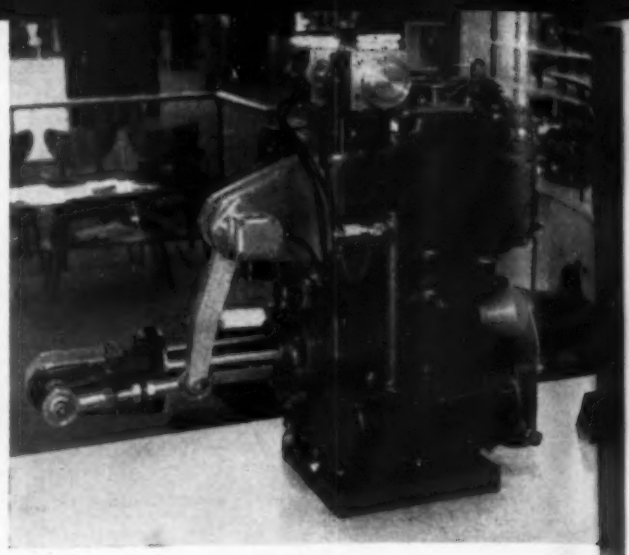
The roller-blind attitude indicator has been found to give a rather clearer indication of attitude than earlier systems using a bar and aircraft silhouette. Shown for the first time by the **Sperry Gyroscope Company** was a roller-blind version of their miniature artificial horizon, the H.L. 9. This has a very small dial face and a standard 3½in S.A.E. case, and is intended to be remotely driven by a normal Sperry gyro vertical. Because the latter is not fully free the horizon does not cover all-attitude flight, but the performance of present standard non-toppling horizons is maintained. Possible applications for this instrument are as a standby unit or as a miniature instrument to be driven by the S. G. Brown M.R.G. This latter combination was mentioned in connection with the Gnat. Surprisingly enough, there is room in the Gnat for the M.R.G. and the main problem is power supply.

In company with the miniature roller-blind instrument, Sperry showed two versions of the H.L.9 miniature A.C./D.C. gyro horizons, one with a conventional bar and silhouette and a small drum indicating angle of dive or climb. The other had a two-coloured wide bar presentation.

Ferranti, Ltd., themselves have produced the wide bar presentation, described in *Flight* for August 30, and have now incorporated this presentation in the F.H.7 miniature horizon which has a 3½in standard S.A.E. case. The latest thinking on these instruments is that they should be combined with a ball slip indicator and replace the conventional turn-and-slip indicator. This is itself regarded as a standby instrument and has often been D.C.-operated for this purpose. Now it is proposed that a miniature A.C./D.C. horizon be carried, possibly with alternative battery operation, and equipped for any of the latest features, such as automatic levelling and 20-sec erection. An accurate horizon unit and a slip indicator are sufficient to allow a pilot to control his aircraft adequately in attitude. The F.H.7, despite its small size, can have all these features and has proved to have a performance superior to that of the larger Services Mk 4.

ON THE GROUND . . .

POWERED FLYING CONTROLS



This Boulton Paul flying control is the first electrically signalled system to be flown.

PROGRESS, rather than brand-new design, was the keynote of the powered flying controls and systems on display at this year's show. A firm which can boast new production orders for well-proved flying controls is **Automotive Products,** whose Lockheed Servodynes are to be used on the D.H. Comet and Sud Caravelle.

Many manufacturers are looking ahead to the time when the linkage between the control column and the pilot is replaced by electrical signalling and a great deal of development work is being done on the reliability and refinement of such systems.

An important step that has been taken in this direction is to replace D.C. systems, with their attendant potentiometer wiper problems—delicately controlled loading, arcing at altitudes and the "staircase" effect as the wiper moves from wire to wire—with smaller and neater A.C. pick-offs and torque motors with very few moving parts. Where there is still a divergence of opinion (or perhaps a determined open-mindedness) is in the degree of standby and emergency measures that should be provided. The opinion generally held twelve months ago was that the first electrically signalled systems should have a manual linkage (not manual control-surface operation) standby system, with clutches operating automatically in the event of failure of the primary electrical signalling. Now, manufacturers are not quite sure, although **Boulton Paul Aircraft** very wisely used an early design of powered control that would give emergency manual reversion from the stick to the surface when they flew the first electrically signalled system in the Tay-Viscount.

Although this was a D.C. system, they demonstrated an A.C. torque motor system on their stand. A pair of torque motors mounted on a differential bridge control the servo valve master piston. A pick-off is mounted on the torque link (which prevents rotation of the screwjack output) to provide a position feed back, and a rate feed back pick-off on the slave valve prevents input signal overshoot.

The company were also showing their split control surface aileron jack, which is now coming into production. These are used in multiples—one to each section—and operate independently. Both radial and swash-plate pumping elements are used.

The **Fairey Aviation Company** also showed electrically signalled A.C. systems (in conjunction with Newmark, Ferranti and Maclaren), although to demonstrate the sensitivity and accuracy that could be obtained the dead-beat qualities of the control had been somewhat sacrificed. Fairey are among the companies who prefer to wait for control thoughts to crystallize further before they finalize their signalling system. At present, a single circuit is used; duplication and triplication are both possible, they say, and can readily be provided if needed. R.A.E. assessment of Fairey's work in this field is to be made in the near future.

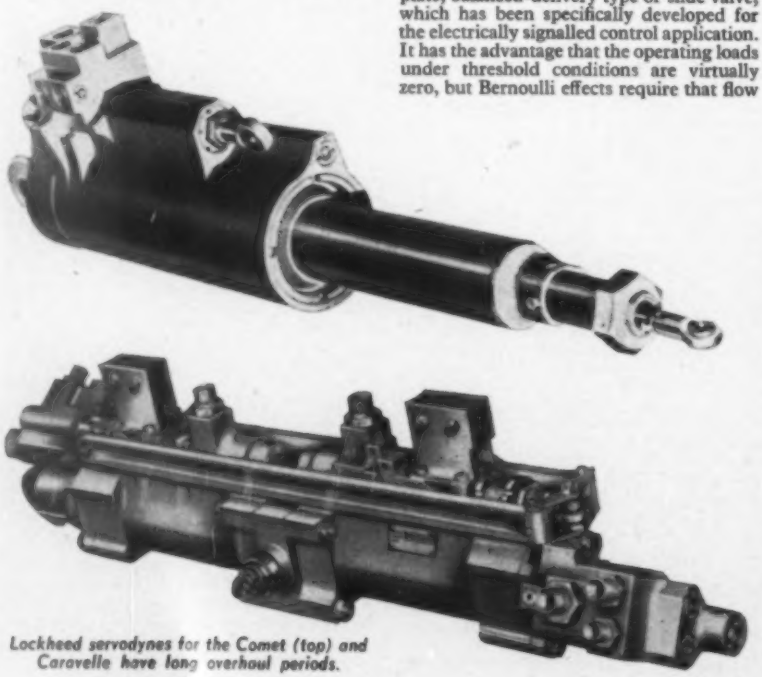
The company has now accumulated much valuable experience with the flat plate, balanced-delivery type of slide valve, which has been specifically developed for the electrically signalled control application. It has the advantage that the operating loads under threshold conditions are virtually zero, but Bernoulli effects require that flow rates higher than 3 g.p.m. should be handled by two-stage valves. Controls with both single and double stage were demonstrated on Fairey's stand, and a miniature control column proved that the operating loads were very light.

The company were also demonstrating a feel simulator in which stick rate could be varied with altitude and Mach number. It consists of a circular leaf spring loading a cam which is restrained between a slide. A roller on the stick follows the profile. The cam is shaped to give V^2 feel up to Mach 1.0 where the spring force—and consequently stick rate—is modified by an electro-hydraulic actuator operating on a closed loop in much the same way as an electrically signalled control system.

Other types of simple and Mach-corrected V^2 feel simulators—in production for a number of aircraft—were shown on the **H. M. Hobson** stand. Hobson's are also developing a simulator following a "V" law, which makes use of the variable-area property of a dished diaphragm as it is deflected. The company has also continued with electrically signalled powered flying control development and—following the general trend—makes use of magnetic amplifiers and A.C. pick-offs in conjunction with the Type 309 piston-jack-powered flying control.

It can now be said that Hobson have been collaborating with the A. V. Roe Weapons Division in this work for about ten months; and to prove its reliability a Hobson-Avro non-active system will shortly be flown for 1,000 hr in a Dakota. Hobson, who have long been in the forefront of flying control design, consider that triplication of the electrical stick/control connection, leaving a "majority-rule" signal if a failure occurs, is probably the optimum that can be achieved. Quadruplication and signal-monitoring systems have been studied, but these give progressively less reliability return as complication is increased. Only practical experience can prove the best course to take, but by putting forward positive arguments, Hobson seem likely to set the pace.

A new flying control to this country appears on **Turner Manufacturing Company's** stand. Designed by M. René Leduc, these controls are of the fixed cylinder type and feature automatic mechanical locking for manual operation following total hydraulic failure and depletion of the main and emergency accumulators. The aircraft control linkage is very simple as the internal ball-type valve is operated through an axial piston rod. Rubber-teflon sealing rings are used on the main piston and the control force required can be adjusted between 1.8 and 3.5 oz; but the fluid resistance to be overcome in manual operation



Lockheed servodynes for the Comet (top) and Caravelle have long overhaul periods.

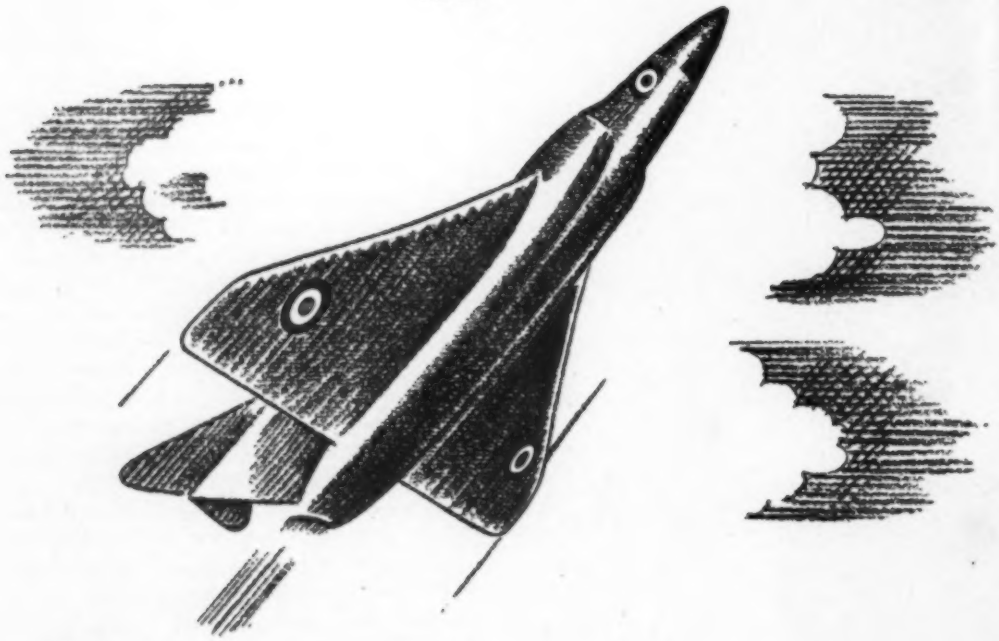
AVRO VULCAN

now in squadron service with the R.A.F.

The Avro Vulcan, the world's first 4-jet delta bomber, has entered the Royal Air Force for full squadron service. Behind the recent Air Ministry announcement lies a brilliant chapter of aeronautical progress that marks the beginning of a new era in Britain's air power. With its near sonic speed, its great range and altitude and its large carrying capacity, the Vulcan can deliver a bigger bomb load faster, higher and further than any other aircraft. Add to this its fighter-like manœuvrability, exceptional safety and pleasant handling characteristics and you have the reasons why the Vulcan is the most effective bomber in service today. But that is not all . . . the Vulcan has a great development potential . . . it has been engineered to allow for new operational requirements which can be met without major alteration to the basic design. In the tough testing ground of the R.A.F. on routine exercises and on long-range training flights, the Vulcan is already showing its paces. Like its illustrious predecessors from the Avro stable—the Lincoln, the Lancaster, the Anson, the 504 and many others—the Vulcan is destined to become one of the world's really great aircraft.

WINGS DAY SEPT. 14th
GIVE FOR THOSE WHO GAVE

A. V. ROE & CO. LIMITED — MANCHESTER / ENGLAND
Member of The Hawker Siddeley Group/Pioneer...and World Leader in Aviation



feet on the ground!

AIR INDIA INTERNATIONAL

BOAC CANADIAN PACIFIC AIRLINES

INDIAN AIRLINES CORPORATION

KLM LUFTHANSA QANTAS

ROYAL AIR FORCE ROYAL AUSTRALIAN AIR FORCE

ROYAL CANADIAN AIR FORCE ROYAL CANADIAN NAVY

ROYAL NAVY SABENA SOUTH AFRICAN AIR FORCE

All these airlines and airforces have recognised the full value to be obtained from the Redifon training equipment which they have ordered — so effecting a complete change for the better in the economics of their crew training.

Less cost — no training risks.

For so much can be done on the ground.

Redifon

FLIGHT SIMULATOR DIVISION

REDIFON LIMITED · GATWICK ROAD · CRAWLEY · SUSSEX

A Manufacturing Company in the Rediffusion Group

ON THE GROUND . . .

naturally requires considerably more effort. A damper is also incorporated, but is inactive in the manual mode.

Another new flying control valve unit was displayed by **Dowty Equipment**, and this incorporated autostabilization for supersonic flight. This autostabilizer is operated by hydraulic units governed by torque motors which receive their signals in the normal way from sensing gyros in the aircraft. Other autostabilizing equipment was shown by Fairey and by **Louis Newmark** and components for such systems by **Elliott Bros. (London)**.

PROCESSES AND MATERIALS

THE whole aircraft industry has one technical aim in common: to reconcile the conflicting needs of greater and greater strength with more and more lightness. No startling new developments were noted this year: the general impression was of a steady improvement in the fabricating properties of alloys and of an ever-increasing application of plastics.

Aero Research exhibited the application of a new Araldite resin designed to give glass-cloth laminates good flexural properties up to 250 deg C, claiming it to be the first resin to ensure satisfactory mechanical properties at such high temperatures. An aerodynamically perfect free-flight model of the SR.53, loaned to Aero Research by R.A.E. Bedford, was also shown. This was made from Araldite impregnated glass-cloth, and its wings were accurate to within 0.005in. The same company showed exhibits of the increasing application for press-tools of glass-cloth mouldings, claiming cheapness and long-lasting stability as advantages.

British Refrasil showed applications of Refrasil, a light silica material which can withstand continuous temperatures of up to 1,000 deg C. Covered with stainless steel foil, it is extensively applied to the insulation of jet pipes.

B.B. Chemicals showed a new application of Bostik—to the bonding of the thin trailing edges of helicopter blades where great flexibility is required, but where riveting and conventional adhesive bonding are not suitable. The compound is Bostik S26.30. This firm showed also new developments in fuel tank sealing and pressure cabin sealing, involving a new liquid synthetic rubber known as Thiokol. It depends for its setting on a chemical process rather than on solvent-evaporation.

Magnesium Elektron ensured the attraction of visitors by displaying the gold-plated magnesium shell of the American earth satellite (made by an American firm). Alongside was the nose cone of the Skylark, the British I.G.Y. upper-atmosphere research vehicle. Shown for the first time was ZTX, a new magnesium wrought (as opposed to cast) alloy for use at high temperatures; containing thorium, it retains its mechanical properties—particularly its modulus of elasticity—up to about 300 deg C.

Prominent on the **Fibreglass** stand was a rocket boost motor case made of glass fibre as made by Bristol. As an example of the infinite variety of intricate shapes possible with Fibreglass, a gleaming white airborne life raft container (made by **Cascelloid** for **R.F.D.**) was displayed.

Of particular interest on the **Electro Hydraulics** stand (and prompting, like all good ideas, the question "Why hasn't this been done before?") was a transparent hydraulic fluid reservoir, made of epoxy or polyester impregnated Fibreglass, which enables the oil level to be seen easily, thus simplifying the daily checking procedure.

Microcell. Although a material with a range of uses far wider even than those to be found in the aircraft and G.W. industry, Microceram is of immediate interest to that industry since it promises to form an ideal material for the construction of radar noses (a closely related, but independently developed, material is being used for this purpose in the U.S.A.).

Microceram is a private venture and is described as a crystalline form of a non-crystalline glass, lying midway between most glasses and most ceramics. Among its properties are the following: hardness greater than stainless steel or granite; rigidity and hardness tested satisfactorily to 2,000 deg C and unimpaired up to 2,000 deg F; exceptional thermal-shock resistance (specimens at 1,650 deg C have been quenched in liquid gas at −25 deg C without harm); dielectric constant of the order of 10^5 at 4.2; tensile strength about 3,500 lb/sq in and compressive strength of about 40,000 lb/sq in; coefficient of thermal expansion of 2.8×10^{-6} at 600 deg C; specific gravity of 1.8. It is in the development stage as a high-speed ballistic skinning material, and is also likely to find applications as a cutting-tool material or a refractory lining.

High Duty Alloys showed that high strength aluminium alloys need not be difficult material to work. Specially processed Hiduminium 66 was shown transformed into a Comet 4 air intake pressing, a tricky drop hammer job for conventionally prepared high strength alloys.

On the **Jablo** stand a new application of Jablite—for pressure cabin insulation—was noted. Conventional cabin insulation materials can pick up as much as 140 lb of water condensation on a single flight, but Jablite is virtually impervious to water. This material, which is being used extensively for building insulation, is made of "expanded polystyrene," and proclaims the virtues of buoyancy, good thermal and sound insulating properties, and lightness (1.1 lb/cu ft). It is also rotproof and bugproof. The waterproof buoyancy property was convincingly demonstrated by a section attached to a piece of fuselage skin, the whole weighing 12 oz, which remained floating in a water tank throughout the display with a 4 lb weight trying to submerge it. Another Jablo material can be applied also to aircraft carpeting; a Jablon underlay faced with a Courtauld synthetic surface (in any desired colour) has been developed for this purpose.

Another form of carpet was shown by **T. F. Firth**, whose stand was carpeted with Airweight (39 oz/per sq yd). The material was the same as that suppled to B.O.A.C. for the recent redecoration of their Stratocruiser fleet. A green seat-covering fabric, also as supplied by T. F. Firth for B.O.A.C. Stratocruisers, was shown as applied to the Argonaut seat.

Dunlop showed the results of their development of fluid hoses from the remarkable I.C.I.-produced P.T.F.E. This retains good properties in temperatures varying from −70 deg C up to 300 deg C, and withstands pressures of up to 4,000 lb/sq in. It can be generally applied to hoses, being suitable for all fluids and gases. The chief aeronautical application appears to be to engine fuel systems, and good vibration properties as well as low friction (enabling smaller bore pipes) are claimed. Dunlop showed also hoses made of Fleximet, a new method of fabricating steel (virtually a flexible bellows made into a pipe).

SAFETY EQUIPMENT

AFTER gaining the world aeroplane height record recently, Mike Randrup, the pilot, was photographed wearing a pressure jerkin Mk 1 made by **Frankenstein, Ltd.** He apparently did not wear the g-suit Mk 4 which is intended to be worn with this jerkin and which can be permanently inflated to provide partial pressure. It was admitted at the time, however, that the jerkin was not the garment he wore during the actual record flight. There is a more advanced garment, but no details of it have been released. Similarly the full-pressure suit situation seems to have progressed to the point where **Siebe Gorman, Ltd.**, are no longer showing their version of it and Frankenstein were not allowed to show their suit.

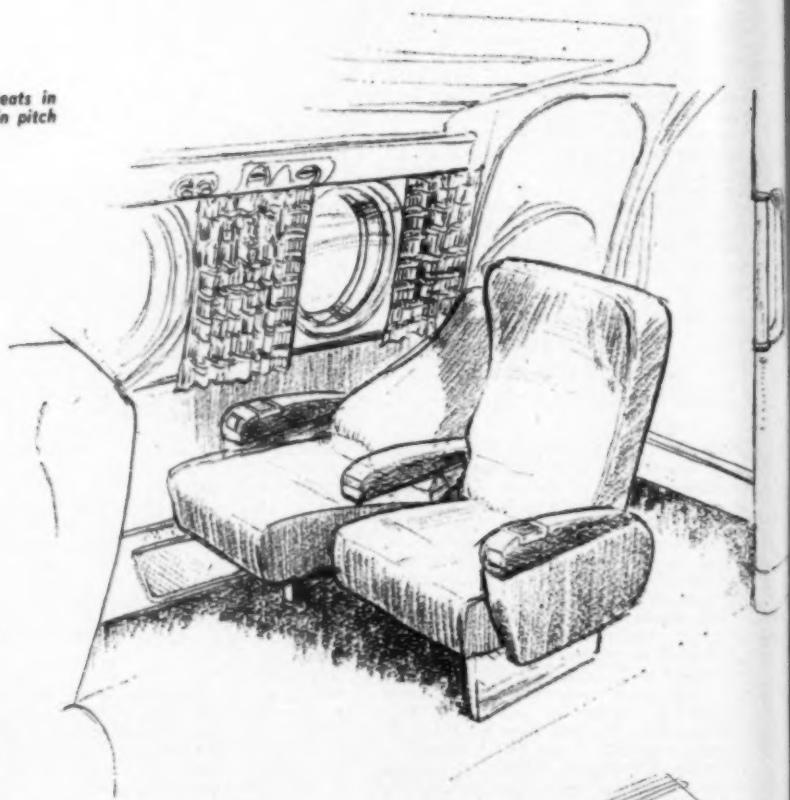
Because of the characteristics of pressure clothing it has been decided to adopt a new form of Mae West for extreme altitude flying. This was shown by Frankenstein and consists of a doughnut-shaped flotation bag which holds the wearer under the armpits, supports him in the water at an angle of 45 deg and provides him with a headrest. When not inflated the apparatus is stowed in pockets round the pilot's waist, and his chest is, therefore, left unencumbered. In the meantime, however, **G.Q., Ltd.**, exhibited a new integral flying suit called Harness Type D Mk 3. It is based on the new standard suit with the full range of zip pockets, but has the normal Mae West and Sarah rescue beacon sewn on to the suit itself. Other integral fittings include an oxygen bale-out bottle, attached low down on the right leg and steadied by retaining straps. A special knife with an

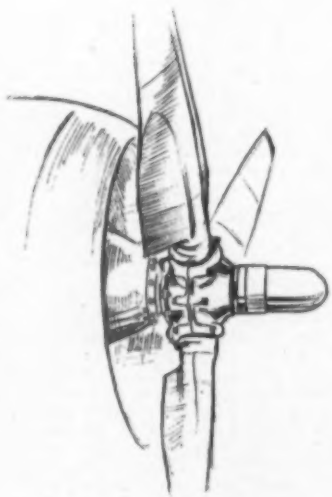
(*Continued on page 456, after double page of drawings*)

A dummy wearing the Baxter, Woodhouse and Taylor partial pressure helmet, Frankenstein pressure jerkin Mk 1, with integral Mae West inflated, and g-suit Mk 4.

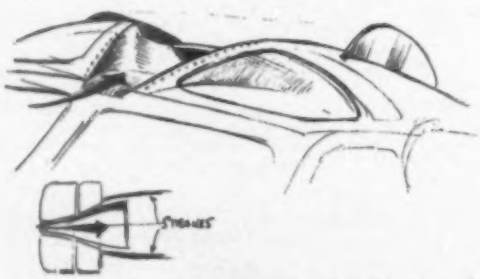
ON THE GROUND . . .

(Right) The last row of first-class seats in the El Al Britannia. Seats are at 54in pitch and the aisle is 24in wide.

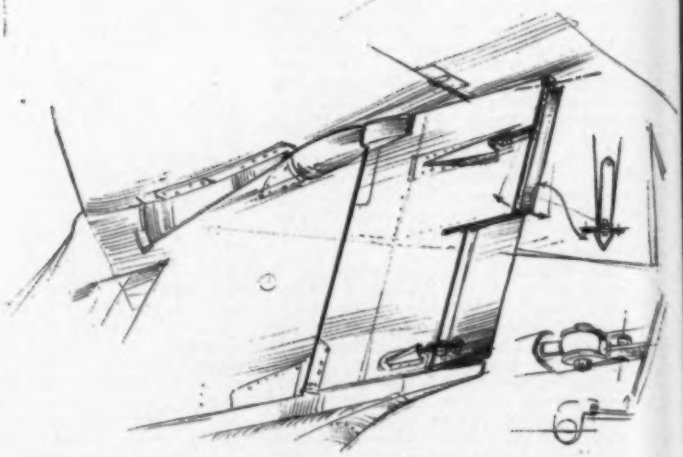




(Above) Blade-root cuffs on a de Havilland propeller of the Scottish Aviation Military Twin Pioneer. The blades are matt black.

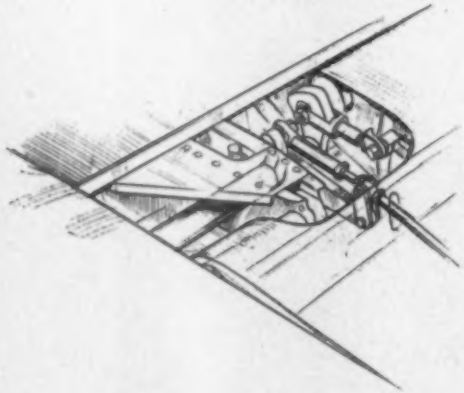


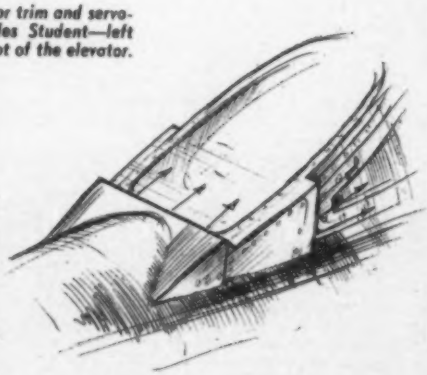
(Above) Air intake and dorsal strakes on the Miles Student (Blackburn Marboré).



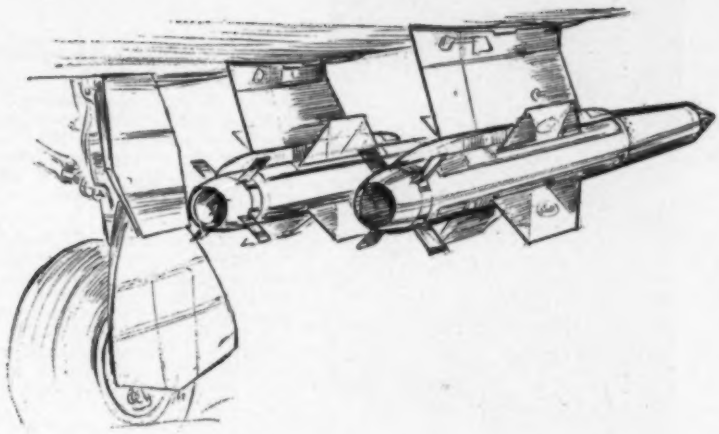
(Above) Anti-snake device on the rudder of the Saunders-Roe SR.53, above the geared tab.

(Below) Combined elevator trim and servo-tab linkage on the Miles Student—left completely exposed at root of the elevator.





(Left) Another detail of the SR.53—the hot-air system for the windscreen.



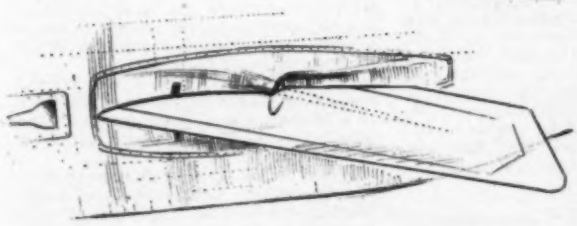
Installation of two de Havilland Firestreak missiles under the starboard wing of the Gloster Javelin FAW.7.

A DIVERSITY OF DETAILS

"*Flight*" *Sketches by* ARTHUR BOWBEER *and* FRANK MUNGER

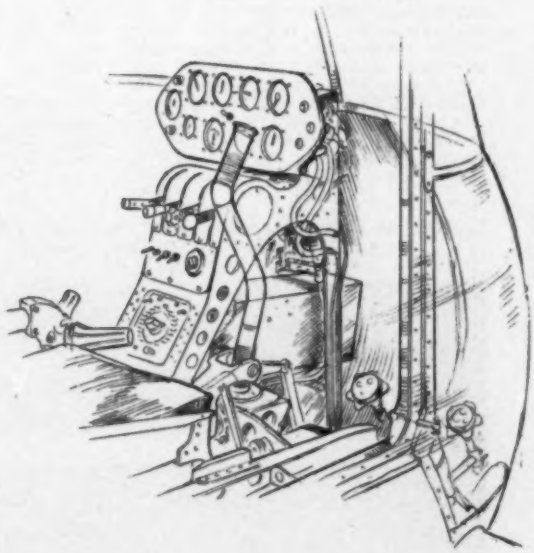
(Left) Stretcher rig on the ambulance version of the Saunders-Roe Skeeter. The upper sketch shows the complete installation, and the lower one the framework and hinging nose section. The patients can receive attention in flight.

(Below) The cockpit of the newest version of the Fairey Ultra-Light, with revised panel, console, pedals and radio installation.



(Above) Showing the unusual axis of the tailplane hinge on the English Electric P.1B. The surface is a "slab."

Sharp taper in the P.1B's wing thickness towards the tip. Note also the blunt trailing edge of the aileron.



One of the most recent undercarriages by Dowty is that for the Saunders-Roe SR.53 mixed-power supersonic aircraft. These close-ups show the main and nose units of the second SR.53. The main tyres are Dunlop size 22 by 5.50.

ON THE GROUND . . .

intriguing curved blade is also carried.

The most important feature of this new suit is an integral parachute harness consisting of suitably disposed webs of nylon cord housed between the suit and a soft, completely detachable nylon lining. The main lift webs emerge at each shoulder and carry standard observer-type parachute hooks retained on the chest in the normal way. The sole fastening on this harness is a simple buckle across the chest which stays inside the suit. No harness adjustment is required. When baling out, the crew member attaches his chest-type parachute in the normal way and, when the parachute opens, the strain on the lift webs tightens the harness evenly round his body. Thus, until the harness is used in earnest, it remains loose and comfortable. The whole suit can be taken apart quickly when it is to be laundered. The Harness Type D is intended for V-bomber crews and is to replace the present separate suit and Mae West and permanently worn back-type parachute.

G.Q. also exhibited the High Altitude Test Flying Head-Piece which is now in limited production and was worn by Mike Randrup and his crew member for the height record flights. A distinctive feature is the permanently closed transparent face-piece which, to avoid misting, consists of a double-layer perspex moulding. Mechanical constriction (partial pressure) is applied in case of cabin pressure failure by inflating three rubber bladders around the sides and back of the head.

The plastic shell of the helmet covers only the forward part of the head and face, the back and sides being contained in a laced cloth helmet. A zip is provided for donning. The helmet is not attached to the other pressure garments covering the body. Considerable experience to date has shown this equipment to be very comfortable, a particular feature being that much of the weight has been kept well back and the "sagging" load on the neck is very small. Field of vision and freedom of movement are good.

The company also showed a partial pressure helmet with movable face-piece designed for the R.C.A.F. and worn by a dummy sitting in a Sabre 6 ejection seat. Both these helmets can be covered by a plastic shell, for crash-protection, which can carry a sliding sun visor.

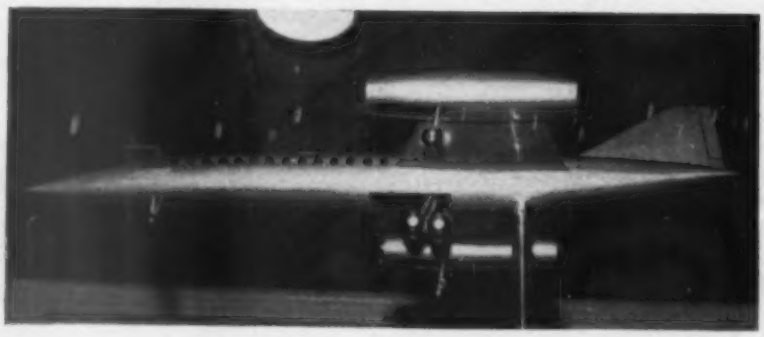
Another partial pressure helmet which is now also in fairly general use by test pilots during high altitude flights is that produced by **Baxter, Woodhouse and Taylor, Ltd.** On the stand this year, it was substantially the same as last year, but incorporated a number of improvements. The face visor is now retained in the open position by a catch operated by a bladder sensitive to cabin pressure. When this pressure drops the catch is released and the visor automatically slams into the closed position, whereafter the pilot may lock it home by pulling down a bar which remains slightly raised in front of his face. A sliding sun visor is housed in a double lining inside the helmet. Mechanical pressure is exerted in the normal way by a series of bladders, and main and emergency oxygen supplies are incorporated. The Durestos shell is made by **Turner Brothers, Ltd.**

Both the G.Q. and Taylor helmets have feed ports officially described as being provided "for feeding and vomiting."

UNDERCARRIAGES

THE firm of **Electro-Hydraulics** provided one of the undercarriage surprises of the exhibition. Displayed on their stand was a model of a supersonic airliner with undercarriage (functioning) comprising one four-wheel bogie in the belly, a single-wheel leg in each wing-tip engine nacelle and a conventional dual-wheel nose gear. The resemblance between the model and the recently cancelled Avro supersonic bomber design was apparently no coincidence; the Electro-Hydraulics company have been co-operating closely with Avro on the design of this undercarriage.

Described in an adjacent paragraph is the projected "Quadricycle" undercarriage by Electro-Hydraulics, Ltd., seen on a model of a supersonic airliner.



Previous solutions to the problem of where to stow heavy main undercarriages in thin-winged supersonic transports have been of the twin-bogie bicycle (B-47) type, with lightly-stressed wing-tip outriggers. The Electro-Hydraulics arrangement solves the "bicycle's" disadvantage of having no differential braking, and its difficult touchdown characteristics. Runway load distribution should be good and, of course, conventional and effective nosewheel steering would be retained. The designers are believed to have reached an advanced stage with this undercarriage.

New on the **Goodyear** stand was the simple co-rotating nosewheel and tubeless tyre for the Aviation Traders Accountant. Goodyear, like most other tyre manufacturers, still have open minds about the relative advantages of dimpled treads. Tubeless tyres, however, are rapidly becoming universal. It was learned from Goodyear that their wheel design is depending more and more on forgings rather than castings. The company showed also their Tri-Metallic brake (as fitted to the DC-7C and to later Viscounts). The name is derived from the fact that the friction elements are made up from three specially alloyed metals; the brake is of the disc type, but Goodyear are going in for the name Tri-Metallic rather than multi-disc to emphasize the new conception of the design.

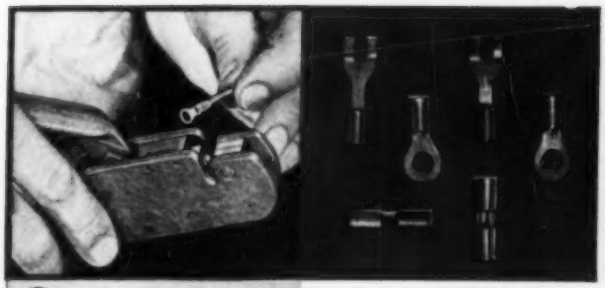
On the **Dunlop** stand it was noticed that a new kind of flexible hose was fitted to a Maxaret wheel-brake system on display. This was manufactured out of the recent grade of P.T.F.E.

It was noted that the Dunlop tyres on the Comet 3's main four-wheel bogies were of two different kinds: two tyres per bogie were of the conventional large-dimpled type, the other two being multi-dimpled, the installation being presumably to compare wear.

Although not shown by British Messier, this company's undercarriages for the P.1A and the P.1B were notable examples of what can be done in the reconciliation of high speeds and loadings with minimum stowage space. The nosewheel of the P.1B incorporates an advanced new type of shimmy damping.

Dowty exhibited the main undercarriage as supplied for the new version of the Vulcan, the B.2. This differs from that of the B.1 in that Dural replaces magnesium, an indication of the heavier duties performed by the B.2 gear. Dowty displayed also the Friendship undercarriage as supplied to Fokker and Fairchild.

components for the aircraft industry

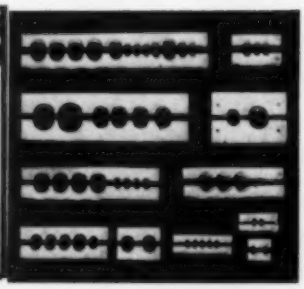


compression tools and terminals

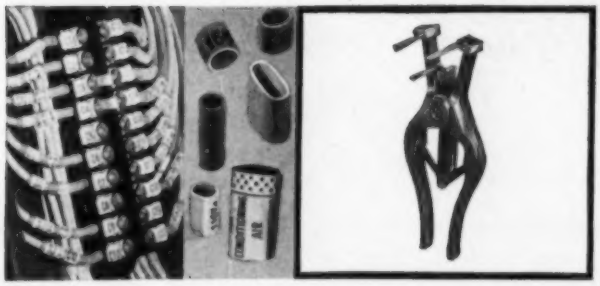
sealing devices and connectors

P clips

cable strapping and studs



polythene pipe cleats



cable binding and identification sleeves

sleeve fitting tools

Hellermann

HELLERMANN LIMITED CRAWLEY SUSSEX

Crawley 2000 (7 lines)

A Subsidiary Company of Bowthorpe Holdings Ltd

GRAVINER
FIREWIRE

COMPLETE INSTALLATIONS HAVE LOGGED

over 1,500,000

FLYING HOURS

INDIVIDUAL ELEMENTS HAVE LOGGED

over 7,500,000

FLYING HOURS

GRAVINER MANUFACTURING COMPANY LIMITED · COLNBROOK · BUCKS

TELEPHONE · COLNBROOK 2345 (6 lines)

Specialists in Industrial Thermostats, Overheat Switches and Industrial Explosion Protection Equipment

G46

A high strength Hiduminium for elevated temperature applications

Hiduminium **RR58**

is now available in sheet form

Specification DTD 5070

For many years Hiduminium RR.58 has been widely used as a forging, stamping and pressing alloy for high temperature applications. It is now being produced as clad sheet. Under conditions of short soaking times up to a temperature of 370°C. Hiduminium RR.58 retains its properties to a greater extent than any other alloy.

It is also superior to other aluminium alloys under conditions of extensive soaking times where temperatures of approximately 180° — 270°C. are used.

The reliability and attractive mechanical properties of Hiduminium RR.58 sheet at these elevated temperatures make it particularly suitable for such applications as skinning for guided missiles, on high-speed aircraft, and as structural sheet in the vicinity of engines.

Full technical data will be sent on request.

Hiduminium
makes the most of
Aluminium

HIGH DUTY ALLOYS LTD · SLOUGH · BUCKS

THE VERSATILE

Pembroke

(Powered by Alvis 'Leonides' engines)

Now in service with the Air Forces of seven nations, the PEMBROKE is rugged, dependable and versatile. The PEMBROKE is particularly suitable for the transport of senior staff officers, in which role it is equipped to carry six passengers. The standard communications aircraft carries up to ten passengers in either forward or rearward facing seats which are quickly removable for conversion to the freighting, photographic, ambulance or supply dropping roles. Pilot training, and aircrew training for which the aircraft is equipped as a flying classroom, complete the varied roles in which the PEMBROKE can be operated. Provision is made for all these roles in the basic structure.

HUNTING PERCIVAL AIRCRAFT LTD

A Hunting Group Company

LUTON, BEDFORDSHIRE, ENGLAND and at 1450, O'CONNOR DRIVE, TORONTO, CANADA

FARNBOROUGH'S FORMAL SEND-OFF

Points from the Speeches at the Show-Eve Dinner

MORE than 1,000 guests were present at the 1957 S.B.A.C. Flying Display dinner, which (as briefly reported last week) was held at the Dorchester Hotel, London, on the eve of the show.

The president, Mr. C. F. Uwins, welcomed the guests and in a brief review of the industry's activities said that they were particularly proud that during 1956 our exports had reached a total of over £100m—an increase of nearly 60 per cent on the preceding year. He went on to say that the bewildering rate of technological progress in aeronautics had been paralleled in the associated realms of electronics and atomic power, and these sciences had combined to place in the hands of three countries a weapon capable of utter and complete devastation: "Here then is the supreme achievement against which our plans for the present and the future must be surveyed."

A change in defence policy, continued Mr. Uwins, was not unexpected. For years we had expected the era of "push-button" warfare, and the successes achieved by our guided weapons had clearly indicated that the date must be near. Nevertheless, the scope of the changes which were to be made had left us all a little breathless and had speeded even more vigorously our endeavours in the field of commercial transport aircraft. And so at Farnborough they would see increasing emphasis laid upon aircraft for civil use, embracing the widest possible range of duties.

"If the policy of the White Paper is to be properly and effectively carried through," Mr. Uwins went on, "the Armed Services must require far larger numbers of transport aircraft than they at present possess. Wherever possible, their needs should be tied in with the requirements of the world's airlines, for by so doing we should stimulate a home market for transport aircraft sufficiently large to enable us to continue to compete for business in equipping airline fleets all over the world.

"The success of British-built civil aircraft in the hands of many operators all over the world has already been most convincing, and during the coming year additional overseas airlines will be introducing British transports on their routes. We acknowledge most warmly the help the industry receives in the development of these aircraft from the operations of our State Corporations—B.O.A.C. and B.E.A.—and we particularly congratulate both Corporations on the improving results they show year by year.

"But while we applaud their performance, at the same time we feel apprehensive over the difficulties which our independent operators have to face. We shall continue to press for greater freedom for these companies to acquire aircraft of the latest and most economical types. The important recommendations by the Air League merit special study in the highest quarters, for the valuable work of the independent operators must in the changing aeronautical climate claim our constant support."

Mr. Uwins said that during the past year the industry had continued to equip itself with all the instruments and tools of research and development. No fewer than 60 wind tunnels of ranges up to high supersonic speeds were now available.

As the Minister of Supply, Mr. Aubrey Jones, had said, aircraft research and development in all its aspects—especially in the problems of supersonic and hypersonic flight—must go on. There was no calling a halt at any particular Mach number. Nor should we ignore the investigation of the pressing problems of structures, systems and materials necessary to enable unmanned as well as manned aircraft to fly ever higher and higher and faster and faster.

Our interest in the unmanned, as well as in the manned, aircraft field would be demonstrated most graphically in the show at Farnborough. There they would find what was probably the most comprehensive display of guided missiles and their appropriate launchers that had yet been assembled in one place. For the first time, the result of years of effort, employing thousands of our best technical brains, would be on view.

The president introduced as the Society's chief guest the First Sea Lord, Admiral of the Fleet Earl Mountbatten of Burma. Earl Mountbatten said that he was not himself a professional aviator—"but I have done my best, as Chief of the Naval Staff, to get the right advice. The Vice-Chief of Staff, the Deputy Chief of Staff and two Assistant Deputy Chiefs are all aviators wearing wings." His own qualification to speak on this occasion was that the Navy, having been buying aircraft for over 50 years, was the industry's oldest and most regular customer. He spoke of its early realization that to control the sea a nation must control the air over it; and there was more than twice as much air over the sea as over land.

"When, in April 1918, the Royal Naval Air Service and the Flying Corps amalgamated to form the Royal Air Force," continued Earl Mountbatten, "the Naval contribution was 3,000 aircraft, 123 air stations and 67,000 men—which showed that they took seriously this matter of the command of the air over the sea."

Nowadays that command was met in two ways: by embarked aircraft of the Fleet Air Arm and the carriers, and by the shore-based aircraft of Coastal Command. It was the Admiralty's greatest wish that this Command should be allowed to have an adequate number of modern aircraft with which to fulfil their functions.

Turning to the subject of guided missiles, the First Sea Lord caused laughter by remarking: "It was in 1943 that the Admiralty first started on a paper on producing a guided missile—and at lightning speed, over 13 years later, we have one. It is now flying extremely well. We are very proud of Sea Slug and feel that it has a great future in the Navy.

"The Americans have a guided weapon called Regulus," he continued, "which will fly a distance of a few hundred miles and deliver a thermonuclear attack. The claim we have heard from the other side of the Iron Curtain about an intercontinental ballistic missile which will fly 600 miles and have an accuracy of 12 miles at the other end is something I rather doubt. But they might follow the American lead and get a guided missile for short range. More than half the world's total population lives 50 miles from the coast. Of 55 cities which have a million inhabitants each, 40 are on the coast and a submarine could come up and lob a missile at them at point-blank range."

Earl Mountbatten concluded by remarking that, pound for pound, the exports of the aircraft industry had the greatest value, because they probably represented more pounds sterling for pounds weight exported than the products of any other industry in this country.

R.A.F. AIRFIELDS FOR PRIVATE PILOTS

A LIST of 80 R.A.F. airfields which, subject to certain conditions, may be used by private aircraft is contained in the current issue of the *Private Aircraft Owners' Newsletter*, circulated to private-owner members and associate members of the Royal Aero Club. The Air Ministry's action in reviewing its policy on this subject (the new list was published in Notam 566 during July) follows suggestions at the R.Ae.C. symposium last February.

JAPANESE AIRCRAFT PRODUCTION

IN a Government White Paper published recently in Tokyo it was claimed that Japan's aircraft industry had recovered from the war so quickly that, like Britain's, it could be turned into a key export industry. Revived in 1952 after being heavily damaged during the war and outlawed during the occupation, it now had 80 acres of factory floor space and a working force of 11,000 men employed by ten aircraft manufacturers.

American military orders had accounted for four-fifths of repair work and half of production up to the end of last year. These orders, however, are expected to drop off considerably and the industry is in process of changing over to contracts from the Japanese Defence Board. The White Paper said that by last March a total of some 18 F-86Fs and 54 T-33As had been produced and delivered to the Board. By 1958 a total of 210 T-35s and by 1959 a total of 300 F-86Fs will have been delivered to the Board under the Japanese-U.S. production agreement.

CO-INCIDENTAL ARCHÆOLOGY

AN air-to-air photograph of a Slingsby Skylark 2, taken by a news agency photographer during the National Gliding Championships and published in *The Times* of August 2, has led to the discovery of the site of a late Iron Age or Roman-British enclosure at Weston Patrick, Hampshire. A semicircular marking on a field in the foreground of the photograph was noticed by Mr. O. G. S. Crawford, formerly archæological officer to the Ordnance Survey; a later ground inspection confirmed the existence of the ancient site.

For some years, aerial photography and inspection have been used in archæological investigations. An illustrated article describing the techniques employed and typical results obtained, entitled *Archæology From The Air*, appeared in *Flight* for February 19, 1954.

Bristol Helicopter over the Coast. MICHAEL H. WEBBER

Venoms of No. 8 Squadron, Arabia PAMELA DREW

The Painted Sky

LONDON'S Guildhall has once again opened its doors to the fourth annual exhibition of the Society of Aviation Artists. With its range wider than ever this year's offering is full of interest and diversion. There is a strong movement away from factual technical statement and with the gentler sex taking a greater part in this hitherto mainly masculine field one is never quite sure where a landing will be made.

The approaches are certainly varied—even from outer space, with long streamers of charged solar particles, as in No. 15, by W. Howard Jarvis, attractive in its vast blue-green emptiness; or by contrast there is Pamela Drew's *Venoms of No. 8 Squadron* in almost a brown monochrome with overpoweringly strong fluid lines—reminiscent of Van Gogh—subduing the aircraft to furtive shapes as they slide over the hostile terrain. Or again, *Bristol Helicopter over the Coast*, by Michael Webber; pleasing in colour, it is frankly Impressionist, contrasting well with the work of Frank Wootton, whose sure touch paints in a Canberra sleekly against a snow-covered background; and *Comet in the Sun* (Beresford M. Johnson) holds more than a hint of the Flemish masters.

Trans-Air Building, by Deborah Jones, is bright and full of painterly qualities; one has an impression of Cuneo here. Very attractive colouring marks *The Passing Storm*, by C. J. Hugill,

The Passing Storm C. J. HUGILL

Visualized Trajectories of Charged Solar Particles, Interstellar Debris, and Flying Saucers W. HOWARD JARVIS

"Trans-Air" Building, Gatwick DEBORAH JONES

The Winning Canberra—New Zealand Air Race
FRANK WOOTTON

Comet in the Sun BERESFORD M. JOHNSON

with his bright yellow aircraft flying bravely against a strong dark blue sky; and topical indeed (for this is the 30th anniversary year of Lindbergh's Atlantic flight) is Kenneth McDonough's picture of the Ryan monoplane over Paris in a very strong design with the aircraft prominent against a scintillating background of Paris by night.

Unusual in design and treatment is a subtly coloured painting, again by Pamela Drew, of a Bristol Sycamore over Port Said. In heavy impasto, the helicopter hovers over an oily sea through which sleek shark-finned dhows glide between amorphous islands. This trend towards making technical detail subservient to the picture as a whole is widely evident in this exhibition, although the balance is well held with paintings such as that of G. D. Coulsen's *High Speed Run*, depicting a Vautour making a low pass, the aircraft full of savage impact as it comes hurtling out of the picture. The subject is masterfully handled in water colour and gouache. In quieter mood, but full of atmosphere, *Twenty Years* (David Shepherd) shows a Westland helicopter winching up two airmen from the sea, whilst a symbolic Lysander circles in the background.

Altogether there is enough variety here to satisfy all tastes and to make one wish the exhibition could be of a more permanent nature (it ends on September 21).

R. M.

Lindbergh — First Non-stop Flight from New York to Paris, 1927
KENNETH MCDONOUGH

The Vanguard cockpit for T.C.A., as seen by visitors to Vickers' stand at Farnborough. It is described below. The first Vanguard is expected to fly in September 1958, possibly in time for next year's S.B.A.C. Display.

"Flight" photograph

CIVIL AVIATION

STRONG WORDS AT MADRID

THE theme of the I.A.T.A. annual report delivered by Sir William Hildred at Madrid last Monday concerned the airlines' financial situation. The report opened the I.A.T.A. annual general meeting, and reflected the thoughts uppermost in the minds of the 79 airlines present.

By coincidence, or perhaps by intent, a sub-committee of the U.S. House of Representatives has just issued a report on its enquiry into the U.S. air transport industry. The committee called on the Civil Aeronautics Board to re-examine its approval of international fares recommended by I.A.T.A., which it referred to as "an international cartel." I.A.T.A.'s mechanism, it said, had resulted in "substitution of monopolistic price-fixing for free competition."

Although Sir William did not mention the C.A.B. directly in his annual report, the following remarks can have referred to none other than that institution: ". . . The relentless forces of inflation have again got under way," he said, "and regretfully, but in accordance with sound business principles, we have tried to pass on this increase to the users of air transport. Yet we have not been allowed to do so and have had a lot of things thrown at us to show why we do not deserve it."

The system of government regulation which, said Sir William, restricted the airlines to inadequate returns on investment, "added insult to injury by superimposing its own accounting system on the financial returns of every airline." The process involved "going through airline accounts with a toothcomb," disallowing certain items and adjusting others, all of them in such a way "as to inflate the operating profit and to shrink the capital base."

I.A.T.A.'s need for a fare increase, said Sir William, did not mean that they had "set aside the policy developing new low fares to attract the currently untapped strata of the travel market," but it did mean that they were trying to lift the whole rate structure just a fraction higher to avoid falling back on government aid.

Sir William's argument was that the airlines should be allowed to accumulate reserves which would even out the fluctuations in profits; and these reserves could in the first place only be obtained through an adequate operating profit margin.

"Flight" photograph

Big business for Napier was foreshadowed by this model on the firm's stand at Farnborough of a Panair do Brasil Constellation 749 fitted with Eland turboprops in place of its Wright piston engines.

THE VANGUARD'S COCKPIT

CONNOISSEURS of modern transport-cockpit design should —if the mock-up on the Vickers stand at the recent S.B.A.C. Display (see photograph above) was a guide—be delighted with the Vanguard. Pilots have seldom been known to agree on their requirements, but it is doubtful whether many will find cause for criticism in the basic layout of the Vanguard cockpit as designed for the aircraft's first export customer, T.C.A.

It is laid out for two-crew operation, and all essential instruments, controls and switches are within easy reach and/or view of both pilots. The central pedestal incorporates the throttles (which are duplicated—an unusual feature), the customary control-levers for the main services, and the radio controls. A compact square panel above the windscreen carries most of the aircraft-systems controls, and the main panel contains the flight and engine instruments (including the Collins Flight System) and most of the emergencies. The pilots enter their seats by "walking round from the outside" (as in the Stratocruiser—the most spacious cockpit of all), and no turning-round or neck-craning is necessary in the execution of cockpit duties. Most noticeable is the exceptionally fine visibility, upwards and downwards as well as outwards. There is a jump-seat between the pilots and a fourth "occasional" position behind the captain for supernumerary crew.

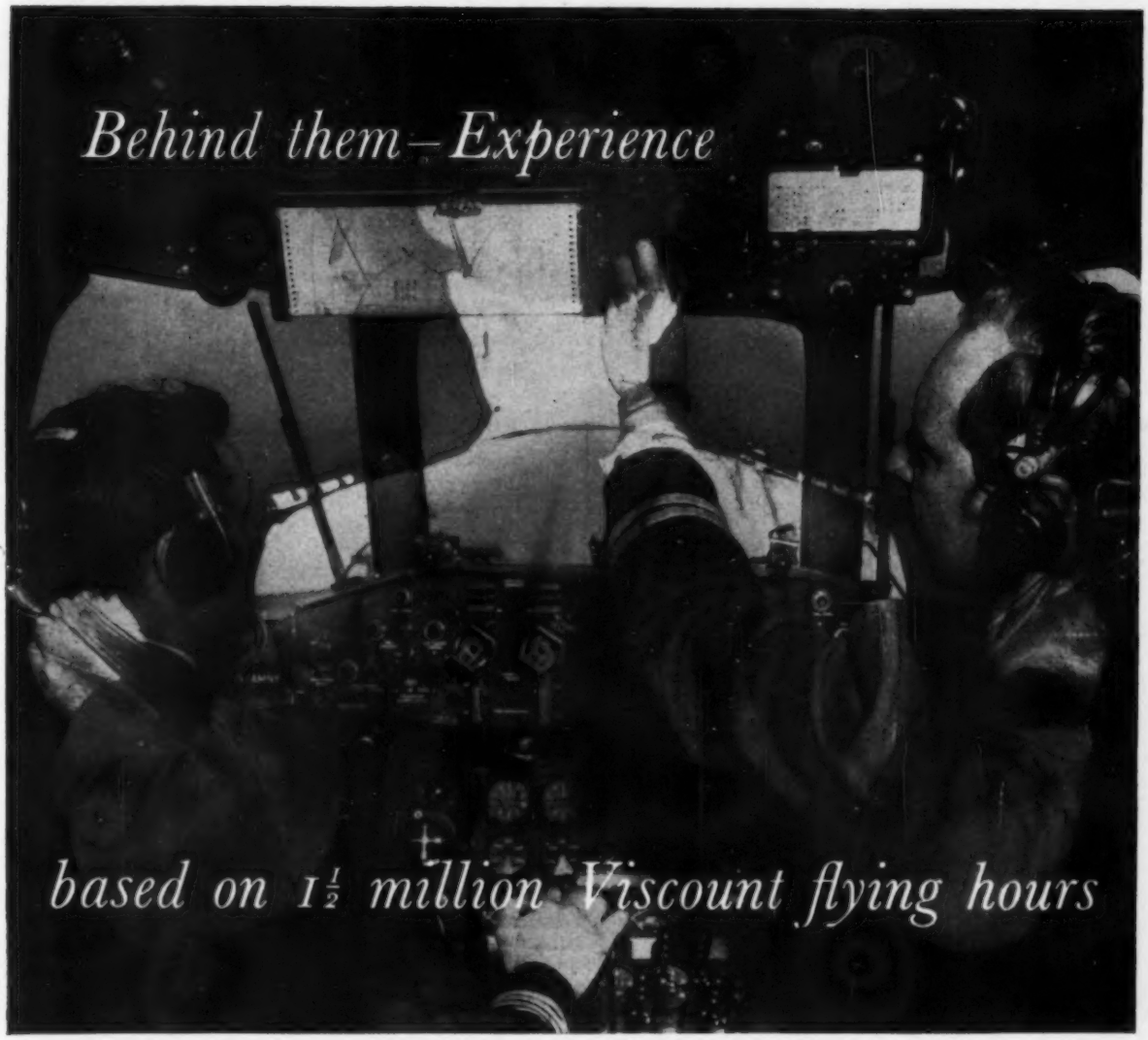
QANTAS LOOKS BOTH WAYS

AT a gathering in London on August 29, Sir Hudson Fysh and Mr. C. O. Turner, respectively chairman and chief executive of Qantas, talked about their airline's future. The new Qantas service to London—an extension across the U.S.A. of the Pacific route—was the chief topic of conversation, and it was clear that this new service will be more to Qantas than a politically sounder link with the United Kingdom. Qantas have long been watching PanAm uplifting European traffic out of and into Australia—and it has been traffic which they have regarded as rightfully theirs to share.

Mr. Turner did not have an easy task negotiating the necessary rights in Washington ("I was there for 33 days, and I should know"), but it is to be hoped he has an easier time in London, where he is discussing precise details of the Qantas services which will now arrive in London from the other direction. He did not understate the amount of detail to be settled, but said he believed that the basic principles were agreed. (Sir Hudson Fysh remarked that when he went to look for a B.O.A.C.-Qantas agreement in his office recently it was not to be found—"proof enough" of the close partnership existing between the two British Commonwealth operators.)

Mr. Turner was asked about possible Qantas orders for medium-range aircraft: like most airline operators, he was non-committal, but he did not discount the suggestion that Qantas' initial Boeing 707-138s might become the airline's medium-range transport, with 707 Intercontinentals as the long-term long-hauler.

As this issue of *Flight* closed for press, it was announced that Qantas made a net profit in 1956-57 of £A484,000, compared with £A401,000 in 1955/56. Revenues went up to £A19,834,000 from last year's £A15,975,000.



Aer Lingus Success

Mr. J. F. Dempsey, Director and General Manager of Aer Lingus, said recently, "Our fleet of Viscounts played a major part in the success of our twenty-first year of operation, enhancing both our prestige and our business. They have enabled us to provide our passengers with a higher standard of complete comfort and speed. Our salesmen have had something extra to 'sell' in the Viscount and as a result our traffic has shown a steady increase since we acquired these excellent aircraft."

Pilots have many reasons for preferring the Viscount with its proved and reliable non-powered flying controls.

Viscount experience in service with over 20 airlines is being built into the simple functional cockpit and cabin layout of the new Viscount 810-840—ensuring for both pilots and passengers that comfort and freedom from strain which is now associated with Viscount travel. In this new Viscount the proved dependability of the airframe and the Rolls-Royce propeller-turbine, after ten years of development and 1½ million flying hours, means peace of mind for both crew and passengers. Quiet, smooth flight reduces fatigue and improves efficiency, while the rapid turnround due to ease of maintenance means less worry over schedules.

There is no substitute for experience

VICKERS-ARMSTRONGS (AIRCRAFT) LIMITED WEYBRIDGE SURREY

TGA AT548a

EKCO

airborne search radar

for ***BRISTOL BRITANNIA***

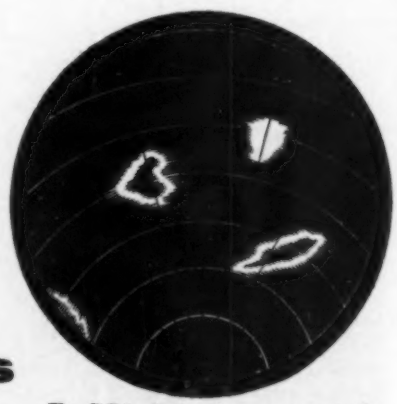
DE HAVILLAND COMET IV

VICKERS VISCOUNT

Already installed with great success in the entire B.O.A.C. Bristol Britannia fleet, Ekco Airborne Search Radar has now been specified for the de Havilland COMET IV and the Vickers VISCOUNT.

It gives warning of turbulent cloud formations up to a range of 120 miles; and includes the Iso-Echo Contour circuit to provide a simple means of distinguishing the amount of turbulence.

It also provides map-painting facilities and a new Ekco Doppler Drift unit can be incorporated as an aid to navigation.



The P.P.I. display shows a sector of space ahead of the aircraft. Cumulo-nimbus cloud cores are indicated by white areas and particularly turbulent regions by black areas surrounded by white.

EKCO electronics

Airborne Search Radar. Airfield Approach Aid.
V.H.F. Communication Equipment.

EKCO ELECTRONICS LTD · EKCO WORKS · SOUTHEND-ON-SEA · ESSEX

CIVIL AVIATION . . .

THE AIRLINES' SHOPPING LIST

Correct to September 4, 1957, excluding options but including certain government and executive orders

THE latest version of *Flight's* specially compiled Airlines' Shopping List is given below, and it is illuminating to compare it with the last one, published in our May 3 issue.

Since May, the total number of aircraft bought or ordered has risen by 125 to 1,479. The British industry's share of the increase in world business only amounted to 44 aircraft ordered, while 19 cancellations reduced this to a net increase of 25. But for the timely entry of the Vickers VC-10 on the scene (with an order from B.O.A.C. for 35), British manufacturers would have had a smaller slice of the cake.

Two British companies whose order books have grown during the last four months are Bristol (Aeronaves de Mexico and Cubana Aviacion have each ordered two Britannias), and Vickers (with their B.O.A.C. order) and a net total of five more Viscounts.

Other striking features of recent months' trading include the very considerable increase in orders placed with Sud-Est for the Caravelle, while Boeing have also done well, with new orders for 707s totalling 27.

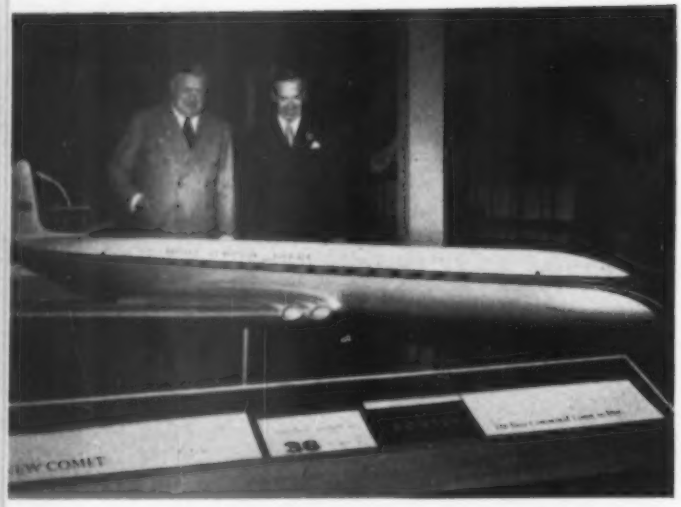
One more outstanding result to record is the steady progress of the Fokker and Fairchild Friendships. Orders for this aeroplane have risen from 76 to 109.

For those interested in the way new business has been shared between jets and turboprops during the past four months, the pendulum appears to have remained on the side of the jet. Of the 96 medium and large turbine transports ordered since May, 10 were turboprops and 86 were jets.

Aircraft	Variant	Powerplant	Airlines (listed in order of purchasing)	Total
Douglas DC-8	Overseas or Long-Range	Pratt and Whitney JT4	PanAm, 25 (Dec. 1959); United, 15 (May 1959); K.L.M., 8 (March 1960); Eastern, 18 (May 1959); J.A.L., 4 (1960); S.A.S., 7 (1960); Panagra, 4 (early 1960); Swissair, 3 (March, June, Oct. 1960); U.A.T., 3 (1960); T.A.I., 2 (1960); Olympic, 2 (1960)	124
	Domestic	Rolls-Royce Conway	T.C.A., 6 (early 1960)	
	Domestic	Pratt and Whitney JT3	United, 15 (May 1959); National, 6 (Midsummer 1959); Delta, 6 (June 1959)	
Boeing 707	120	Pratt and Whitney JT3	PanAm, 6 (Dec. 1958); American, 30 (operation on March 15, 1959); Continental, 4 (May 1959); T.W.A., 15 (from April 1959); Qantas, 7 (Type 138, May to September 1959)	147
	220	Pratt and Whitney JT4	Braniff, 5 (Oct. 1959); Sabena, 4 (Dec. 1959)	
	320	Pratt and Whitney JT4	PanAm, 17 (March 1959); Air France, 17 (Nov. 1959); T.W.A., 18	
	420	Rolls-Royce Conway	Lufthansa, 4 (Summer 1960); Air India, 3 (early 1960); B.O.A.C., 15 (1960); Cubana, 2 (March, June 1960)	
Bristol Britannia	102	Proteus 705	B.O.A.C., 15	70
	250	Proteus 755	R.A.F. Transport Command, 13; M. of S., 3	
	300 series	Proteus 755	M. of S., 1; Northeast, 5 (Oct.-Nov. 1957); Aeronaves de Mexico, 2 (late 1957)	
	310 series	Proteus 755	B.O.A.C., 18 (current); El Al, 3 (current); C.P.A.L., 6 (October 1957-Jan. 1958); Hunting-Clan, 2; Cubana, 2 (late 1958)	
Douglas DC-7C Seven Seas	—	Wright R-3350	PanAm, 33; Swissair, 4; S.A.S., 14; Sabena, 10; Braniff, 7; B.O.A.C., 10; K.L.M., 11; Northwest, 11; R.E.A.L., 3; Panair, 4; T.A.I., 2; Alitalia, 4; C.M.A., 4; J.A.L., 4	121
Lockheed L.1649A	—	Wright R-3350	T.W.A., 25 (current); Air France, 10 (current); L.A.V., 4; Lufthansa, 4 (November 1957)	43
Convair 440 Metropolitan	—	Pratt and Whitney R-2800	R.E.A.L., 10; S.A.S., 11; Finnair (Aero O/Y), 3; Sabena, 12; Swissair, 11; Iberia, 5; Continental, 3; National, 6; Delta, 8 (Jan. 1957); Eastern, 15 (May 1957); Braniff, 5; Alitalia, 2; Jugoslavia (JAT), 1; Lufthansa, 12; Air Carrier Service, 2; R.A.A.F., 2; U.S.A.F., 6; Corporate customers, 11; Karhumaki Airways, 1; Ansett, 10; Italian A.F., 1; Cruzeiro do Sul, 4 (Oct. 1957)	141
Sud-Est Caravelle		Rolls-Royce Avon RA.29	Air France, 24 (late 1958 to late 1960); S.A.S., 6 (April-Oct., 1959)	30
de Havilland Comet	4	Rolls-Royce Avon RA.29	B.O.A.C., 19 (autumn 1958)	25
	4B	Rolls-Royce Avon RA.29	B.E.A., 6 (late 1959 to spring 1960)	
Lockheed Electra		Allison 501	Eastern, 40 (Oct. 1958); American, 35 (Jan. 1959); Braniff, 9 (May 1959); National, 23 (April 1959); K.L.M., 12 (Sept. 1959); Western, 9 (late 1959); Allison, 1; Loftleidir Icelandic Airlines, 2; Braathens, 1; Garuda, 3; Ansett Airways, 3	138
Vickers Viscount	700 & 800 series	Rolls-Royce Dart	*See list below*	374
Vickers Vanguard	950 series	Rolls-Royce Tyne	B.E.A., 20 (March 1960); T.C.A., 20 (Aug. 1960)	40
Vickers VC-10	120-seats	Rolls-Royce Conway	B.O.A.C., 35 (1963)	35
Convair 880		General Electric CJ-805	T.W.A., 30 (late 1959); Delta, 10 (1959); Transcontinental, S.A., 4; R.E.A.L., 4 (late 1959)	48
Fokker F.27 Friendship	Fokker-built	Rolls-Royce Dart	K.L.M., 2; Aer Lingus, 7 (late 1958); T.A.A., 6 (early 1959); B.K.S. Air Transport, 2; Dutch Government, 1; "an Italian company," 1; Braathens, 3; Australian Government, 2; Iranian Oil, 2; Trabajos Aereos y Enlaces (Spain), 3 (spring 1959); Philippine Air Lines, 2 (late 1959); Sabena, 12; Belgian Air Force, 6	109
	Fairchild-built		West Coast Air Lines, 6 (March-Oct. 1958); Mackey, 2 (March 1958); Frontier, 4 (Oct. 1958); Bonanza, 3 (May-June 1958); Piedmont, 12 (April-Oct. 1958); General Tire and Rubber, 1 (1958); Continental Can Co., 1 (1958); Quebecair, 2 (Aug.-Sept. 1959); other U.S. executive versions, 10; Aerovias Ecuatorianas, 1 (Nov. 1958); Northern Consolidated, 3 (Oct. 1958-April 1959); Southwest Airlines, 3 (Sept.-Oct. 1958); Wheeler Airlines (Quebec), 2 (Feb.-March 1959); Avensa, 5 (July 1958-Jan. 1959); Wien Alaska, 3 (Feb.-April 1959); Butler Aviation, 1 (exec., 1959); Bank of Mexico, 1 (exec., 1959)	
Handley Page Herald		Alvis Leonides Major or Rolls-Royce Dart 527	Queensland Airlines and A.N.A.	24
Frye Safari		Wright R-1300 or Pratt and Whitney R-1340	Cruzeiro do Sul, 10; Catalina Airlines (California) 2	12

Vickers-Armstrongs Viscount (all models). The following list of confirmed orders accounts for 374 aircraft, as follows: B.E.A., 27 V.701 (Dart 505), 1 V.701 (Dart 506), 24 V.802 (Dart 510), 16 V.806 (Dart 520); B.W.I.A., 4 V.702 (Dart 506); Aer Lingus, 4 V.707 (Dart 505), 3 V.808 (Dart 510); Air France, 12 V.708 (Dart 505); T.A.A., 7 V.720 (Dart 505/6), 7 V.756 (Dart 510); Indian Government, 1 V.723 (Dart 506), 1 V.730 (Dart 506); T.C.A., 15 V.724 (Dart 506); 36 V.757 (Dart 506); Hunting-Clan, 3 V.732 (Dart 506); 2 V.759 (Dart 510)*; Pakistan Government, 1 V.734 (Dart 506); Iraqi Airways, 3 V.735 (Dart 506); 1 V.773 (Dart 506); Fred Olsen, 2 V.736 (Dart 506), 4 V.779 (Dart 510); Canadian Government, 1 V.737 (Dart 506); Misrair, 5 V.739 (Dart 506); Capital, 3 V.744 (Dart 506), 57 V.745 (Dart 510); Butler Air Transport, 2 V.747 (Dart 506); Central African Airways, 5 V.748 (Dart 510); L.A.V., 3 V.749 (Dart 506); B.O.A.C., 7 V.754 (Dart 510), 4 V.722 (Dart 506); Hong Kong, 2 V.760 (Dart 510); U.B.A., 3 V.761 (Dart 510); Hughes Tool Co., 1 V.763 (Dart 510); U.S. Steel Corp., 3 V.764 (Dart 510); Standard Oil, 1 V.765 (Dart 510); Indian Airlines, 10 V.768 (Dart 510); K.L.M., 9 V.803 (Dart 510); Transair, 2 V.804 (Dart 510); New Zealand N.A.C., 3 V.807 (Dart 510); Continental, 15 V.812 (Dart 525); South African Airways, 7 V.813 (Dart 525); Iranian Airways, 3 V.782 (Dart 510); Lufthansa, 9 V.814 (Dart 525); Philippine Air Lines, 2 V.784 (Dart 510); L.A.I., 10 V.785 (Dart 510); South African Government, 1 V.781 (Dart 510); Pakistan Air Lines, 3 V.815 (Dart 525); Cubana, 3 V.755 (Dart 510), 4 V.818 (Dart 525); Lloyd Aero Colombiano, 3 V.786 (Dart 510); Brazilian Government, 1 V.742, 1 V.789 (Dart 510); P.L.U.N.A., 3 V.769 (Dart 510); Niarchos, 1 V.819 (Dart 525); Black Lion Aviation, 1 V.825; Eagle Aviation, 2 V.805; Turkish Air Lines, 5; V.A.S.P., 5 V.827.

* *The 732s leased to M.E.A., the 759s sold to Icelandair.*



Lord Douglas, chairman of B.E.A. (left), and Mr. A. F. Burke, managing director of de Havilland Aircraft, seen with the model of the Comet 4B —six have just been ordered by B.E.A.—on the D.H. stand at Farnborough. Lord Douglas is still discussing with manufacturers his longer-term jet transport needs. "Flight" photograph

CIVIL AVIATION . . .

THE PRICE OF THE COMET 4B

UNLIKE most announcements of new orders for transport aircraft, the news of B.E.A.'s order for six Comet 4Bs, as released by de Havilland and B.E.A. at the end of last month, made no mention of price. The cost of the Comet 4B was not quoted by de Havilland when the aircraft was announced last May; but from the statement at that time that it had been "reduced in line with manufacturing economies based upon quantity" it was assumed that the figure was of the order of £1 million. (The cost of the Comet 4A in July 1956 was given as £1.21 million.)

Daily newspapers which quoted the value of B.E.A.'s order—presumably including spares—varied in their estimates between £5 million and £9 million, but it is now understood that the price including spares was actually £7 million, indicating a first cost (of the aircraft as specified by B.E.A.) of about £950,000 per aircraft.

DE KROONDUIF ACCIDENT

ONE of the three Twin Pioneers recently delivered to de Kroonduif in Dutch New Guinea crashed over the sea near Biak on August 30. The aircraft was on a training flight, and both pilots were killed. Following the accident, K.L.M. (who manage de Kroonduif) are reported to have grounded the other two aircraft pending an investigation.

De Kroonduif were the first airline to confirm an order for Twin Pioneers. (An up-to-date list of Scottish Aviation orders appeared in *Flight* last week.)

JETSTAR FIRST FLIGHT

LOCKHEED'S CL-329 JetStar 10-seat jet was due to make its first flight on September 4, exactly on the day that the company had planned (and publicly announced) earlier this year, when the project was still in the doodle-pad stage. According to Mr. Kelly Johnson, Lockheed's vice-president of engineering and research (he was responsible for the F-104 Starfighter), a three-view general arrangement drawing was all that existed in January —"and that was largely discarded after wind tunnel tests." He claims that lb for lb the Jetstar has been completed in less time than any other modern aircraft built. The mock-up was finished in 63 days, and a development time of 30 weeks was achieved by side-stepping conventional production methods.

A good many short cuts can be taken in the construction of a one-off aeroplane, but Lockheed are building a second prototype which should be completed next spring. This version will have a four-pod installation of either Fairchild J83s or General Electric J85s in place of the two Bristol Orpheus engines of the first prototype.

Lockheed's haste to get a prototype flying is to steal a march on its competitors (see "Executive Jet Generation," *Flight*, July 12) in the race for a U.S.A.F. contract for one of the two basic types of light utility jet transport and "crew-readiness" trainers. The size of the order (200-300 four-jet aircraft) and the scope for big sales in the civil business market are the reasons for Lockheed's big hurry.

AUTRES TEMPS, MÊMES MŒURS

THE still unresolved feud between B.E.A. and H.M. Customs and Excise over how much duty-free tobacco and spirits should be carried aboard aircraft has spotlighted the urgent need for an overhaul of the Customs regulations applied to air transport. Some of these, as long-suffering airlines frequently point out, were laid down 200 years ago for sailing ships.

B.E.A.'s difficulties hit the headlines when London Airport Customs impounded 40 crates of cigarettes and spirits from the airline's fleet of Viscounts and Elizabethans. Their authority was a regulation allowing only 25 duty-free cigarettes for each passenger on flights which will be out of Britain for less than 24 hours —this in the days when it is possible to fly to Rome and back in less than half that time. B.E.A., which has only a comparatively small number of long flights, suffers considerably from this particular rule. Passengers deprived of their 200 duty-free cigarettes frequently complain.

More serious at a time when airlines are going all out to increase their freighting business—potentially so lucrative—is the case of importers and exporters who suffer Customs clearance delays: freight loads entering the U.K. are often held up for longer than their transit time.

The recently published report of the Select Committee on Customs and Excise included several recommendations that merit favourable consideration. The committee suggested that outward-bound freight be cleared in the warehouse rather than in the central Customs shed. Not only is the central shed at an inconvenient distance from the warehouse, but it is also officially closed for freight clearance for 75 per cent of the working week—despite round-the-clock air services and the fact that air freight provides the greater part of Customs revenue.

Other worthwhile points made in the Report concern the streamlining of procedures for clearing unaccompanied passenger baggage and small freight consignments.

Examination of witnesses by the Committee brought some startling facts to light. For instance, B.E.A. representatives claimed that a saving of £6,000 a year would be made if aircraft food and liquor were cleared when taken from the bonded stores instead of at a specific Customs clearing point as at present.

In fairness, it must be put on record that the flood of criticism and suggestion levelled at the Customs authorities is producing results. The news that Customs formalities for outgoing passengers at Gatwick are to be cut down (as at Paris-Orly—see *Flight*, July 26) was particularly welcome.

NEEDS OF THE JET AGE

THE report of I.C.A.O.'s Jet Operations Requirements Panel has now been submitted to the Air Navigation Commission—the co-ordinating body which puts forward recommendations for the approval of the Council. Described as a "detailed blueprint of the needs of aviation's coming jet age," the report has been issued after nearly a year of panel meetings to consider requirements for aerodromes, air traffic services, meteorology, aids to navigation and communications.

In the main, the recommendations are uncontroversial. The report seems to be less a detailed blueprint than a policy declaration, and wide scope has been left for interpretation of many of the resolutions. No one wants I.C.A.O. to exercise inflexible control over the technical development of operational and navigational aids, nor must requirements be so idealized that they cannot be met, but the guiding hand should be a firm one, and I.C.A.O.—as the international policy shaper—could perhaps afford to adopt a more autocratic attitude in recommending the aids to be adopted.

Thus it is good to see that in the section on *Aerodromes* the panel recommends that "taxiways should be laid out to allow

Evidence of the remarkably rapid progress with B.E.A.'s new Central London terminal in Cromwell Road, South Kensington, is provided by this picture taken last week. The building replaces that soon to be demolished at Waterloo, and it should be in use on October 6.

The Coin may be different but...

the Service is the same

As Air Travel reaches out to all the countries of the world, so must the services which keep the aircraft flying. The BP Aviation Service is international; at hundreds of different airfields it supplies the essential fuelling and other services on which modern Air Travel depends.

AVIATION BP SERVICE

The international aircraft fuelling organisation of
The British Petroleum Company Limited

ICE-FREE FLIGHT

The heat exchanger potential for aircraft has been studied by Delaney Gallay research teams for many years. Throughout there has been the closest contact with the manufacturing aircraft industry and aircraft operators, so that engineering theory and practice have been wedded to commercial considerations.

One practical outcome is the range of Delaney Gallay De-Icing Heat Exchangers. Triumphantly used on many aircraft, including the Viscount series, they have been described as a significant step forward in the development of the aeroplane as an all-weather means of transport.

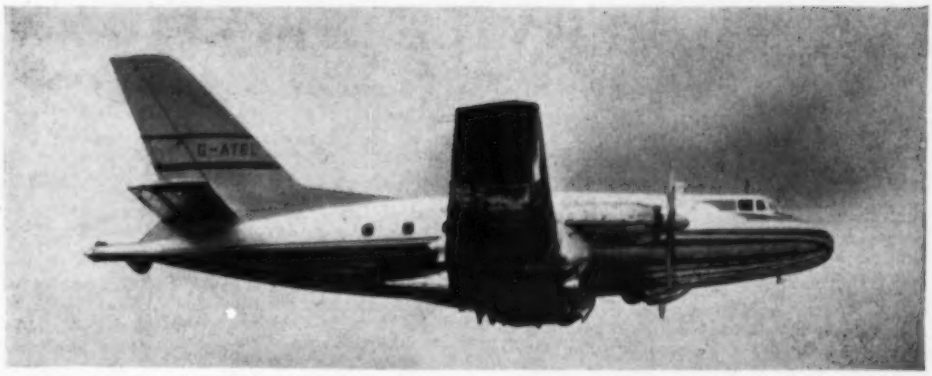
In essence, each Delaney Gallay De-Icing Exchanger utilizes some of the jet engine exhaust gases to heat ram air before directing it to the leading edges of main planes, tail-planes and fins. It has successfully overcome problems associated with other de-icing methods.

Compatible with the needs of the aircraft structural designer, as a piece of equipment it is efficient, thoroughly reliable and completely safe. Its very simplicity enables it to be impressively light in weight.

Full details and illustrations are available to serious enquirers, as part of the service which Delaney Gallay offer to the aircraft industry.

DELANEY GALLAY LTD

Vulcan Works, Edgware Road, London NW 2 *Telephone: GLAdstone 2201*



A new British airliner at the S.B.A.C. display was the Aviation Traders Accountant, a private venture by a small firm —quite a remarkable achievement in these days of strong technical competition and big business in the air transport world. Selling price is £120,000, without furnishings and radio.

"Flight" photograph

CIVIL AVIATION . . .

turns at speeds of 35 to 40 kt," because that is a standard on which design can be based. But the comment that "it may be necessary at civil aerodromes to provide pavements especially resistant to heat and blast effects at run-up areas and at the end of runways" is surprising when the vast accumulation of operational experience is considered; and contractors need to make decisions now if additional runways are to be completed on time.

The panel stipulates that the noise of turbine-engined aircraft should be consistent with that on or in the vicinity of airports accepted now—a reasonable aim for 1960. It further recommends that runway distance markers and "devices in the aircraft" to measure acceleration would assist the pilot to determine whether his take-off is developing safely. A useful supplement to the report is information on the runway length requirements of the various turbojet and turboprop aircraft now being built.

The recommendations of other sections of the report are: *Air Traffic Services*. Positive air traffic control must be maintained at all times regardless of weather conditions; rapid and reliable transmission—preferably automatic in operation—should be provided of position data from air to ground and control directions from ground to air; and the absolute minimum of deviations from filed flight plans should be required by the air traffic control system. A firm recommendation is that airports should have facilities to allow jets to by-pass piston-engined aircraft running up at the end of the runway, but there is a lapse into vague definition when aids for turbine-engined aircraft making uninterrupted climbs to cruising altitude are considered. The panel conclude that climb restrictions in high-density areas should be avoided and "suitably sited precision navigation aids should be provided."

Meteorological Services: It was agreed that the services must cover pressure altitudes of up to 45,000ft; air temperature forecasts accurate to ±1 deg C at intake height along the runway should be ready two hours before take-off, and forecasts of air temperatures at selected pressure levels should be accurate to ±3 deg C. Landing forecasts for the terminal airport and the first alternate should be passed to the pilot before he arrives at the point where a decision to land or to divert must be made. Other forecasts needed by pilots, say the panel, include the altitude of the tropopause along and in the vicinity of the track; and the location and characteristics of any jetstreams, hail, clear air turbulence, turbulence in cloud, mountain waves, aircraft icing and any dense strato-cirrus cloud.

The interim report on *Aids to Navigation* (some comments on which appeared on these pages on August 9) remains unchanged in the final report. The most important recommendation was for an area coverage, medium- and short-range navigation aid providing pictorial presentation in the cockpit.

The final recommendations deal with *Communications*. New techniques, the panel say, will be needed to meet the increasing requirements of air traffic and meteorological services. Among these are radioteletype broadcasts of weather information for receipt in the aircraft in printed form, radio facsimile broadcasts, continuous weather broadcasts, an extension of direct voice communications between controllers and pilots, improved systems of high frequency radiotelephony (such as the compatible single sideband system), automatic calling devices (Selcal) and automatic signalling and data transfer systems for air traffic control purposes.

BREVITIES

THE Irish Ministry of Commerce and Industry has announced that Shannon Airport is to have a new 10,000ft runway to take the "biggest and heaviest" jets planned. It will be capable of extension to at least 11,000ft and will be 150ft wide, with two 25ft shoulders.

* * *

The new runway at Hong Kong airport is reported to be more than two-thirds complete.

* * *

C.P.A.L. is to construct a 2.5-acre aircraft parking block for its Britannias at Vancouver International Airport.

* * *

The President of T.W.A., Mr. Carter Burgess, said in Paris last week that Britain's "refusal" to grant traffic rights to T.W.A. for flights beyond Frankfurt had cost T.W.A. $2,500,000 in 1956.

* * *

The "distinct possibility" of a merger between Capital Airlines and Continental, the two U.S. airlines who have ordered Viscounts, is reported from an American source.

* * *

It is reported that a Rumanian-Dutch air agreement has been signed in Prague. A new Bucharest-Amsterdam scheduled service will be flown by TAROM and K.L.M.; the former will use Il-14s.

* * *

The Russo-Danish Commission investigating the loss of the Il-14 which crashed into Copenhagen harbour on August 15, has said in a statement that the Aeroflot pilot appeared to have lost his direction in the mist.

* * *

Northeast Airlines will inaugurate Washington-Miami services on September 15 with one DC-6B flight in each direction. Its Britannias are scheduled for delivery in November and December of this year.

Revenue ton-miles performed by Swissair during the first half of 1957 increased by 39 per cent over a similar period last year.

* * *

A K.L.M. DC-7C inaugurated the new service between Amsterdam and Houston, Texas, on September 3.

* * *

Lufthansa is planning a service between West Berlin and West Germany. These flights would cross East German territory.

* * *

Central African Airways' last Viking service to London arrived at L.A.P. from Salisbury on August 28. C.A.A. have operated Vikings for nearly five years; Viscounts will replace them.

* * *

The new £4m air terminal building at Dorval, Montreal, will be operating in the spring of 1959. International and domestic traffic will be accommodated under the same roof.

* * *

The Canadian Government air immigration scheme ended on August 31. The load factor was 99.03 per cent and 17,600 people were carried.

* * *

It is reported in *Aviation Daily* that Allison are discussing with North American the equipment of Convair 340s and 440s with Allison turboprops. Talks with PacAero have also been held.

* * *

There is a possibility that Curtis Wright TJ38s (Bristol Zephyr) may be used by both Boeing and Douglas in short-range versions of the DC-8 and 717.

* * *

The All American Engineering Company have proposed their "water squeezer safety arrester" for civil jet transport operation. The device, which is an airfield-overrun safety barrier, has been in use on U.S. Air Force runways for three years (*Flight*, p. 958, December 21, 1956).

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News

S.A.C. Competition

DATES and details of the U.S.A.F. Strategic Air Command bombing, navigation and reconnaissance competition, in which Bomber Command has accepted an invitation to participate, were announced recently by Air Ministry.

It is taking place at Pinecastle A.F.B., Florida, from October 30 to November 5 and two R.A.F. teams will compete, each of two aircraft, representing No. 1 Group (Vulcans) and No. 3 Group (Valiants). There are to be additional aircraft in reserve, and Air Chief Marshal Sir Harry Broadhurst, A.O.C-in-C. Bomber Command, will accompany the teams in a reserve Vulcan.

"At Home" Displays

AN excellent bill of fare—with some specially interesting titbits—is being offered at the 37 R.A.F. stations open to the public tomorrow, September 14, to mark Battle of Britain Week Saturday. It includes (as mentioned in *Flight* for August 16) the first-ever opening of two V-bomber stations, **Honington** in Suffolk and **Gaydon** in Warwickshire; while at **Valley** in Anglesey the Swift F.7s of the recently formed Guided Weapons Development Squadron will also be having their first public view. One of them, with two Fireflash missiles in position, will be in the static park; other Swifts of the G.W.D. Sqn. will show their paces in the air display, which is to be augmented by four R.N. Sea Hawks.

Sea Hawks will also take part at **Lindholme**, near Doncaster, where formations of U.S.A.F. B-45s and F-100s will add further spice to the programme. F-100s are appearing at **Castle Bromwich**, where instructors from the R.A.F. College will perform Vampire formation aerobatics; and there, too—of particular interest to connoisseurs—the Short S.B.5 is due to put in an appearance.

A Service aircraft now rarely seen—the Lincoln—will appear at **Ternhill**, Salop, where the 27-item programme includes R.N. and U.S.A.F. as well as R.A.F. aircraft. At **Little Rissington**, Gloucestershire, the C.F.S. team—"The Sparrows"—is giving the formation aerobatic display in piston-engined Provosts which so pleased their Farnborough audience last week.

Aerobatics form also a main feature of the Scottish "at homes," for the famous team from No. 43 Sqn.—"The Fighting Cocks"—is performing both at its own station, **Turnhouse**, and at **Kinloss** in Morayshire. At Turnhouse, a Chipmunk of Edinburgh University Air Squadron will do aerobatics "on request" by the public; and at Kinloss interest will not be confined to the R.A.F., for the Ecurie Ecosse racing-car team is demonstrating its Jaguars and the team's trophies (including those from Le Mans) will be on display.

At **Acklington** in Northumberland young visitors (if any) who tire of Vulcans and Valiants will be able to have rides in a mock-up Emmett train; and at **Biggin Hill**—where the flying display is to be opened (as mentioned on this page last week) by Mr. Ray Milland, who is in the Cranwell film *High Flight*—there are to be a thousand model aircraft on show in the ground exhibition.

There is sure to be a touch of nostalgia at **Hendon**, site of so many brilliant air displays since 1910, for with the ending of regular Service flying there the 1957 R.A.F. "at home" will probably be its last. Parachuting from a balloon by T.A. paratroopers forms one of the entertainments, and in addition to flying there will be a large static exhibition, where aircraft, engines and a full-scale Fireflash model are being shown.

R.A.F.A. Appeal

IN a letter published to coincide with Battle of Britain Week the chairman of the R.A.F. Benevolent Fund, Viscount Knollys, says that recent announcements of nuclear developments should not mislead people into regarding the commemoration as one having merely "the somewhat musty significance of ancient glories." No matter to what extent Britain turns to guided missiles, there will surely remain a need for a manned air force "throughout the foreseeable future"; and with it the need for the Fund grows rather than diminishes.

Pointing out that it is currently spending £1 per minute every day of the year—and £568,564 in the last financial year—to relieve distress among past and present members, Viscount Knollys urges all who can to mark this Battle of Britain Week by sending a donation to the fund at its headquarters, 67 Portland Place, London, W.1.

International Post

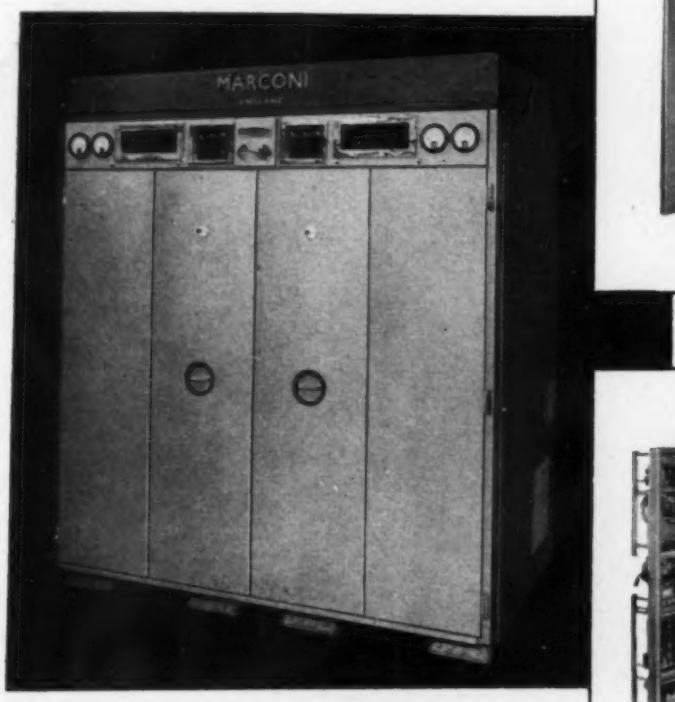
FORMERLY Air Member of Personnel, from 1953 until he retired from the R.A.F. early this year, Air Chief Marshal Sir Francis Fogarty has been appointed

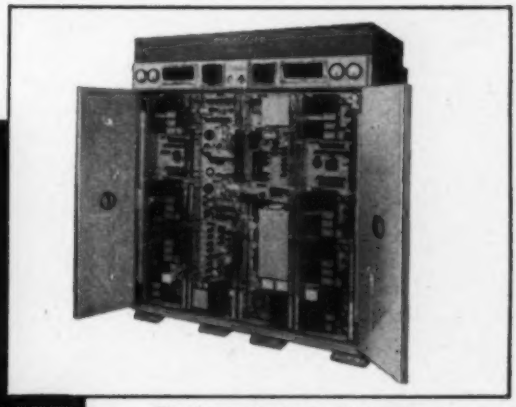
Twelve Gannets of No. 796 Sqn. and five Sea Hawks of No. 738 Sqn. helped to make the Royal Navy's début at the S.B.A.C. Show at Farnborough last week an impressive one. Here one of the Gannets (with another in view) makes a quick getaway from R.N.A.S. Ford. "Flight" photograph

Marconi's *NEW*

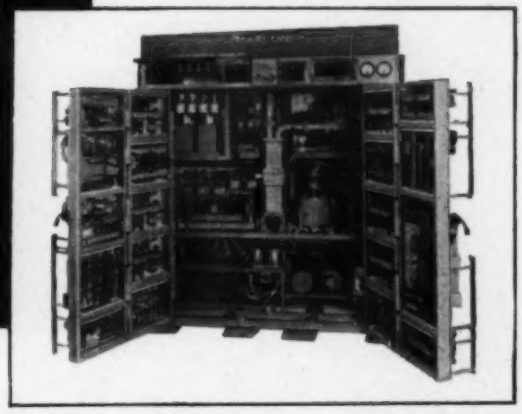
SR1000 RADAR TRANSMITTER RECEIVER

HIGH-POWERED · COMPACT · COMPLETE





The photographs above and below show the ingenious door mounting arrangement of the units which gives complete accessibility



The SR 1000 transmitter has a peak power of three megawatts at 10cm. The receivers are linear and logarithmic. The equipment includes fully comprehensive monitoring facilities and self-contained test equipment. All this and duplexer, magnetron, trigger, impulse transformer and HT supplies are contained within a cabinet measuring only 6 ft. 3 ins. by 3 ft. 4 ins. by 7 ft. 3 ins., to which revolutionary mechanical design gives complete freedom of access.

MARCONI

Planning and Installation of Military and Civil Radar Systems

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED, CHELMSFORD, ESSEX

R4

This Saracen Infantry Carrier

. . . and 15 like it, each weighing 10 tons

complete with their crews and equipment can be flown direct to any operational zone in a single move by a squadron of

Beverleys

Blackburn and General Aircraft Limited. Brough, E. Yorks. England

A96 a

SERVICE AVIATION...

Five aerobatic flight lieutenants, members of the Provost team—"The Sparrows"—from the C.F.S., Little Rissington, which formed part of the R.A.F. representation at Farnborough.

director-general of the English Speaking Union. He takes up the appointment on October 1 in succession to Mr. Frank Darvall, who has retired.

Key Communication

KEYS to its telephone boxes have been issued by the Automobile Association to R.A.F. stations St. Mawgan, Felixstowe, Valley and Thorney Island so that helicopter pilots on rescue flights who cannot make contact with base by radio can land by the roadside and ring up.

Reunions

THIS year's reunion of **No. 208 Sqn.** (formely Naval 8) **Old Comrades Association** will be held at the Swiss Hotel, 53 Old Compton Street, London, W.1, on Saturday, October 26, commencing at 6.30 p.m. There will be a running buffet and past and present members should apply for tickets—price 7s 6d—to the hon. secretary, Mr. R. W. Booker, 28 Greet Road, Lancing, Sussex, as soon as possible.

THE tenth **No. 2 A.D.U.** reunion dinner will be held at the R.A.F. Reserves Club, 14 South Street (off Park Lane), London, W.1, on Saturday, November 2, at 6.30 for 7 p.m. Members are invited to bring lady guests; the cost is one guinea per head; and acceptances should be sent to Humphrey Wynn, Flat B. Oxford Court, Anlaby Road, Teddington, Middx.

Battle of Britain Font

DURING the Battle of Britain service of remembrance being held in the memorial chapel at Biggin Hill next Sunday morning the Bishop of Rochester, the Rt. Rev. C. M. Chavasse, will receive from Marshal of the R.A.F. Lord Tedder and dedicate for use a baptismal font which has been presented by the R.A.F.A. (of which Lord Tedder is president) as a memorial to those who fell in the battle.

The font has been designed by the station padre at Biggin Hill, the Rev. Vivian Symons, and has been cast in aluminium to symbolize the principal material from which aircraft are made. It takes the form of a shallow bowl supported by three "fins," in the sectors of which the station crest—three unsheathed cross-hilt swords, with a gilded chain circlet surrounding each blade—is reproduced. There is to be no inscription on the font or swords, but a plaque placed nearby will commemorate the gift.

Local craftsmen have made the font, the chain circlets were forged in the station workshops, and the sword blades have actually been tempered from those of three swords used in the Crusades. These were donated by the commanding officer of Biggin Hill, W/C. P. D. Thompson.

IN BRIEF

The Secretary of State for Air and members of the Air Council gave a dinner at the R.A.F. Club on September 4 in honour of Air Chief Marshal Sir Ronald Ivelaw-Chapman, on the occasion of his retirement from the Air Council and from the R.A.F.

* * * * *

R.A.F. Finningley, near Doncaster, is to open as a Vulcan bomber station next month.

* * * * *

A total of 450 men and women volunteered for spare-time duty in the R.O.C. during the last quarter.

* * * * *

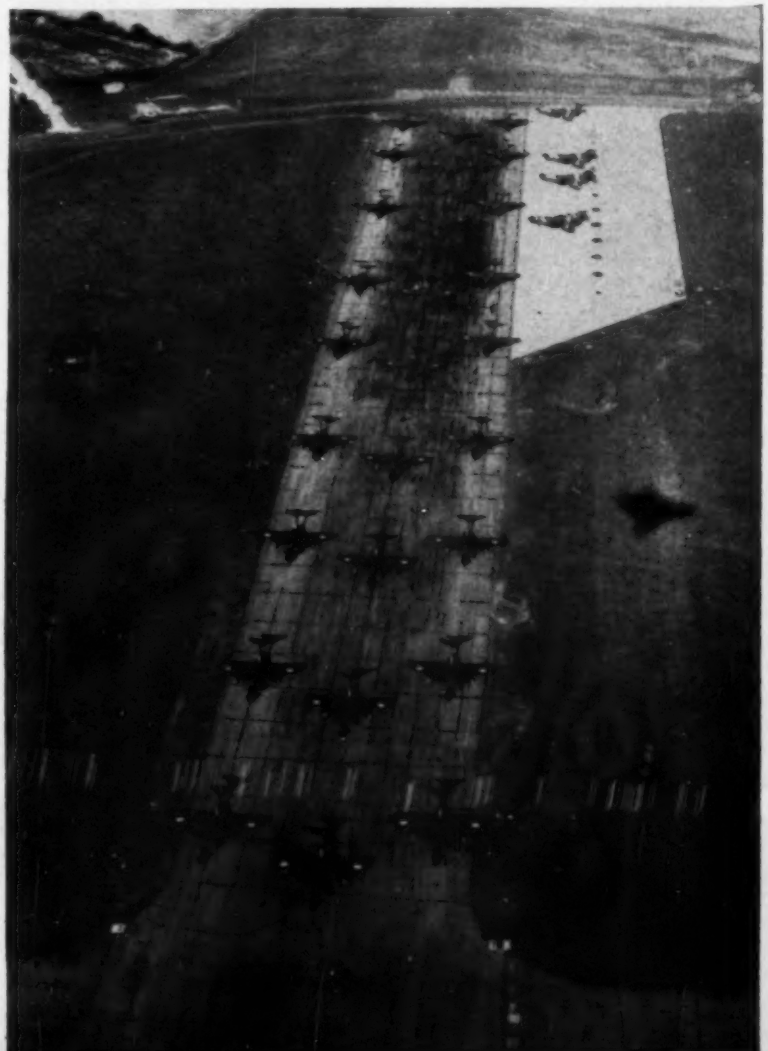
Belgian Air Force technicians have since August 14 been taking a six-week instructional course on Avro CF-100s at the R.C.A.F.'s No. 3 Fighter Wing, Zweibrucken, Germany.

* * * * *

A mobile mass radiography unit from the R.A.F. Hospital at Wegberg recently completed a 30,000-mile tour of isolated camps, during which some 2,000 servicemen, their wives and children and attached civilians were X-rayed.

* * * * *

Following complaints about night flying by jet aircraft over Edinburgh and Dunfermline, the station commander at R.A.F. Turnhouse, W/C. R. C. Haine, has said that this will be "considerably reduced" after a NATO defence exercise at the end of this month.



A pattern of power on the tyre-marked runway at Tangmere, these 27 Javelins of Nos. 23, 46 and 141 Squadrons are photographed (from another Javelin, whose shadow can be seen) when about to take off for the S.B.A.C. display at Farnborough last week

Correspondence

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns; the names and addresses of the writers, not for publication in detail, must in all cases accompany letters.

The Technician and His Status

(In "Flight" for August 30 a letter signed "Twelve Aircraft Technicians" questioned whether the British aircraft engineer enjoyed conditions "in keeping with his professional status," which they maintained was "little better than that of a junior civil servant"; they went on to deplore the fact that they had to punch a time-clock and provide their own cutlery in the canteen, and their own crockery for the tea-break.)

Twelve aircraft designers of satellites to Heaven,
One refused to punch a clock, leaving just eleven.
Eleven air technicians, revolting now and then,
One took higher money, leaving only ten.
Ten aircraft designers signed on the dotted line,
One wrote "dotty" on it, and then there were nine.
Nine aircraft technicians, thinking to migrate,
One flew off too early, leaving only eight.
Eight aircraft designers, one a Scotsman from Loch Leven,
He punched the others on their clocks, leaving only seven.
Seven bright designers found a clock was playing tricks
By punching back at one of them and leaving only six.
Six aircraft designers, spurred onwards by their wives,
Put on such airs and graces they became a singleton of fives.
Five talked of civil servants and agreed they were a bore,
Until one went to Whitehall, leaving only four.
Four designing draughtsmen (junior techs. to you and me)
One flew out to Burbank, so there were only three.
Three aircraft technicians for designing had a flair,
One wouldn't bring his plate along, and so they were a pair.
Two aircraft technicians cried "Conditions are no fun,"
One took off a day or two, and left the other one!
And this lone one reflected, that for all their fun and games,
They'd been so apprehensive they couldn't even sign their names.

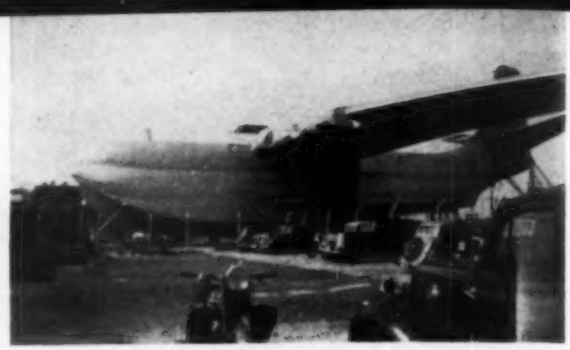
Brighton, Sussex. J. LAURENCE PRITCHARD.

London's Airports

THE recently announced proposals for further extensions at London Airport and the new Gatwick airport and for the development of a *third* airport for London (probably Southend), makes one wonder whether the airport planners are properly briefed on progress and trends in aircraft design.

Before a few more tens of millions are expended on covering the fair face of Britain with slabs of concrete, would it not be as well to note and attempt to assess the implications of the following?

(1) The proposals of the Air League Committee presided over by no less an authority than Sir Miles Thomas for a VTO supersonic transatlantic airliner. If these are taken up the resulting aircraft will not require runways; if jet VTO can successfully be applied to this project it is likely to be applied to most future turboprop and pure-jet transports.



The parked Princess (see letter at foot of column).

(2) The imminent expansion of vertical and short take-off and landing in the short- and medium-range field. Aircraft with these characteristics certainly will not wish to use Southend, whose communications with London are notoriously poor. B.E.A. has lost a lot of money in the past year on internal air services and will continue to do so until it appreciates that operation between city centres offers the only hope of achieving the popularity which can be the only basis for solvency. The next decade will see the introduction of the Rotodyne and Westminster helicopters and, no doubt, of successors to the STOL family, of which the Twin Pioneer represents such a promising beginning. It is upon such aircraft that internal air services will increasingly depend and miles of concrete runway will be of as much use to them as a sick headache (especially if they are miles from the centres of population which they are supposed to serve).

(3) The likelihood of the re-introduction of the flying-boat, especially if atomic powerplants are seriously visualized for the propulsion of commercial aircraft. In any case, it is a fact that the long-range flying-boat can be as efficient economically, if not more so, than the corresponding landplane. It is the natural vehicle for the shipping companies to adopt if they are allowed to take a hand in civil aviation. Apart from economics, the British Commonwealth, whose shores abound in sheltered stretches of water—ready-made and militarily indestructible air bases—cannot afford to be without them.

If these developments materialize, what aircraft will be left to use the runways of London Airport, let alone Gatwick and Southend, when, in another 15 years or so, current aircraft types and their immediate successors, become defunct?

Nicosia, Cyprus. INTEGRATOR.

[*Integrator's postulation, "If these developments materialize," provides the answer to his argument. The nation must provide facilities for the aircraft bought by the world's airlines, or lose its air transport business.*—Ed.]

Parked Princess

ON seeing this ill-fated "Monarch of the Skies" I thought that your readers might be interested in the humiliating position in which the Saunders-Roe Princess prototype has been placed. Never before, I think, has a Princess found her resting place in a car-park. [Photograph above—Ed.] Perhaps the Cocoon hides the blushes on that elegant brow.

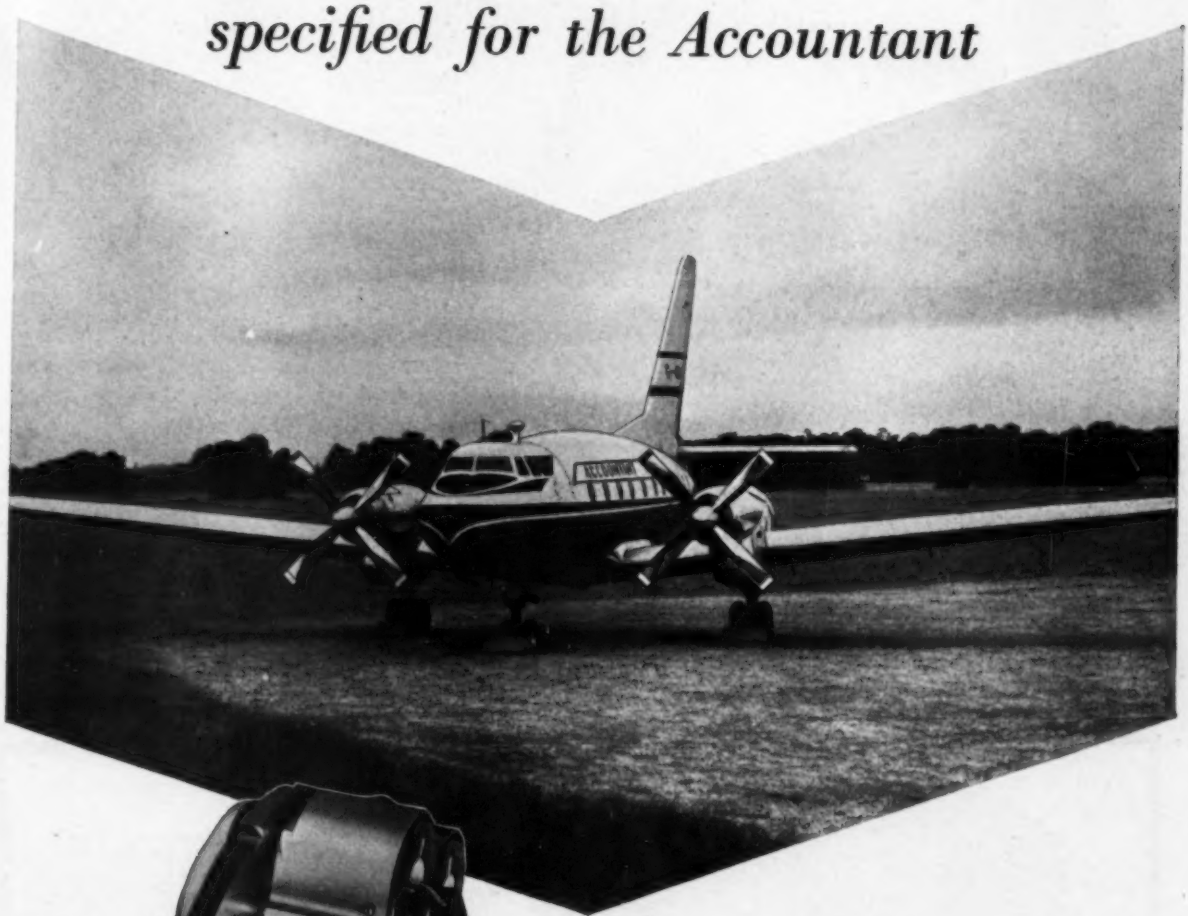
London, S.W.11. SAMUEL P. SMITH.

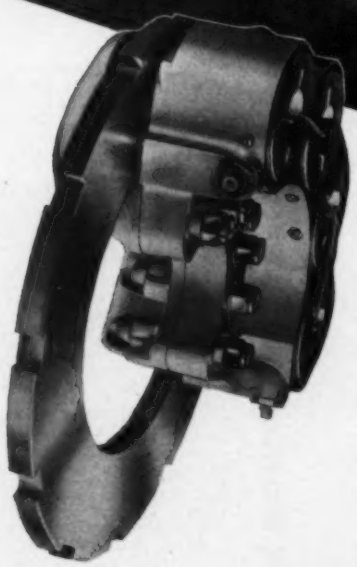
SECONDS IN THE RING: A FLYWEIGHT CHAMPION BETWEEN THE ROUNDS

Ground-servicing the Folland Gnat calls for no trestles or ladders, even to gain access to the control runs and refuelling nozzles in the dorsal spine. The man on the wing is using a dipstick to measure the fuel tank contents. The picture is from Chilbolton, where Gnats are test-flown.

GOODYEAR EQUIPMENT

specified for the Accountant





Aviation Traders (Engineering) Ltd. have specified Goodyear equipment for the new turbo-prop 'Accountant'.

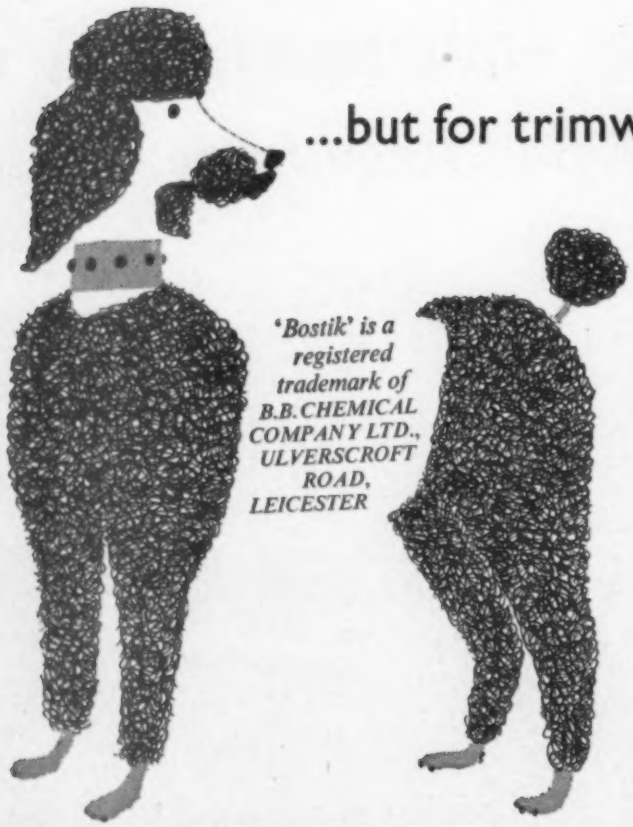
- TYRES, WHEELS, BRAKES
- HYDRAULIC BRAKE CONTROL EQUIPMENT
- ANTI-SKID EQUIPMENT
- SEQUENCE JACK—AUTOMATICALLY BRAKES MAIN WHEELS ON 'TAKE-OFF' BEFORE RETRACTION

Goodyear have been pleased to participate in the development of this new aircraft

GOODYEAR AVIATION PRODUCTS

THE GOODYEAR TYRE & RUBBER CO. (GT. BRITAIN) LIMITED, AVIATION DIVISION, WOLVERHAMPTON.

J



...but for trimwork that lasts...

specify

Bostik

'Bostik' is a registered trademark of B.B. CHEMICAL COMPANY LTD., ULVERSCROFT ROAD, LEICESTER

Where the strongest permanent adhesion is of paramount importance . . . there you will find 'Bostik' adhesives. Developed for the securing of materials as diverse as metal and rubber, plastic, leather and wood, 'Bostik' is the basis of secure trimwork, and proved long-lasting craftsmanship.

Tell you more about Bostik?

We'll be glad to!

WESTON AIRCRAFT INSTRUMENTS

The Model S.122 Form 4 is a high pressure transmitter having ranges of from 0-400 p.s.i. up to 0-6000 p.s.i. The transmitter is contained in a die-cast aluminium case and consists basically of a special form of Bourdon tube which, when under pressure, moves laterally, causing a change in the position of a contact arm wiping across a resistor.
The resultant variations are led away from the transmitter through a three-pin plug, and are fed to a ratiometer indicator operating from the nominal 24 volt supply. The instrument is substantially independent of variations in supply voltage. The working life of this transmitter is unaffected by large and high frequency pulsations in the pressure supply.
Other forms available for pressures of 40 to 120 p.s.i.

SINGLE PHASE AND POLYPHASE WATTHOUR METERS
SYNCHRONOUS TIME SWITCHES
SYNCHRONOUS MOTORS AND MOTOR UNITS

SANGAMO WESTON

PANEL & SWITCHBOARD INSTRUMENTS
D.C. Moving Coil, A.C. Rectifier, H.F. Thermocouple, A.C./D.C. Moving Iron

PORTABLE INSTRUMENTS
D.C. Moving Coil, A.C. Rectifier, H.F. Thermocouple, A.C./D.C. Moving Iron, A.C./D.C. Dynamometer

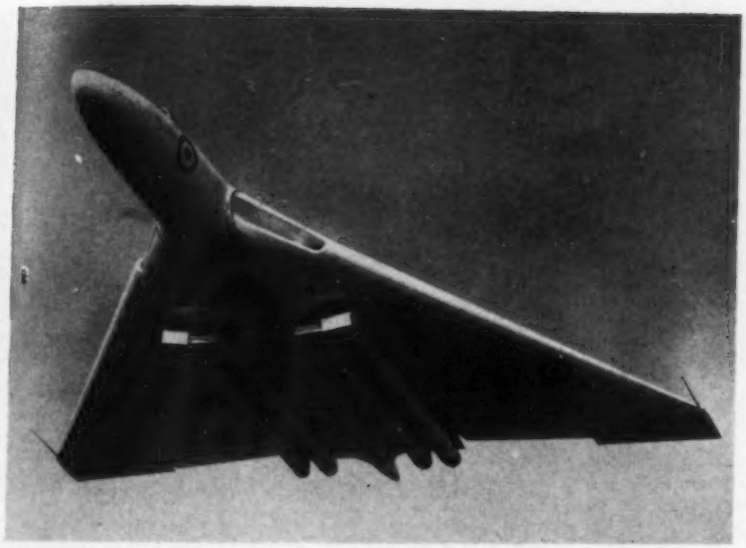
LABORATORY STANDARD INSTRUMENTS
D.C. Moving Coil, A.C./D.C. Dynamometer

CURRENT TRANSFORMERS . FREQUENCY METERS . ALL-PURPOSE TEST SETS
AIRCRAFT INSTRUMENTS . RATIOMETERS
TACHOMETERS . WESTON STANDARD CELLS . ELECTRICAL THERMOMETERS
"PHOTRONIC" PHOTO ELECTRIC CELLS
PHOTOMETERS

SANGAMO WESTON LIMITED
ENFIELD · MIDDLESEX
Telephone: ENfield 3434 (6 lines) & 1242 (6 lines) Grams: Sanwest, Enfield

Scottish Factory: Port Glasgow, Renfrewshire
Port Glasgow 41151
Branches: London, CHAncery 4971
Glasgow, Central 6208 Manchester, Central 7904
Newcastle upon Tyne, Newcastle 26867
Leeds, Leeds 30867 Liverpool, Central 0230
Wolverhampton, Wolverhampton 21912
Nottingham, Nottingham 42403
Bristol, Bristol 21781
Southampton, Sa'ton 23328
Brighton, Brighton 29497

SW/18



THE SNOW-WHITE BIRD

A Real Fairy Story

Here is the beautiful white bird as she looked in the years 1953 and 1955 . . .

. . . and here she is (below) in 1957.

"Flight" photograph

ONCE upon a time there was a lovely white bird, with a wing that looked just like a beautiful sharp triangle. So they called her Delta, after the letter of the old Greeks (though the very learned ones called her Avro Vulcan Delta B.1, second prototype, VX777).

As the years went by she grew a little kink in her lovely wing, which made her fly all the better. So well did she fly with her little kink that the wise ones said, "If you were to grow a bigger wing, with even more kinks in it, you might fly even better, and higher and faster, and everything."

So one year she was seen with a bigger and even more beautiful new wing, with tips all curved and pointed like a lovely leaf. So she was called by the beautiful new name Aerodynamic Vehicle. And when people saw her with her wonderful new wing they cried, "Oh, lovely white one, you were never so beautiful, even when they called you Delta."

And here is the lovely creature as she was in the years 1953, 1955 and 1957.

Which only shows, children, that if you *do* develop a little kink, you may *still* grow up to be beautiful and fast and everything.

THE INDUSTRY

Epoxide Resin Tools

FOUR separate methods of making epoxide resin tools are described in a new booklet published by Bakelite, Ltd., 12-18 Grosvenor Gardens, London, S.W.1. They cover relatively small, and larger, lightly stressed tools of intricate contour (e.g., pantograph and copy milling models, etc.); large lightly loaded tools of non-intricate contour (such as checking and assembly fixtures), and highly stressed tools, particularly press tools for metal forming. All relevant information on epoxide tools is set out in considerable detail—including the materials required, the preparation of materials and moulds, and data on cured epoxide-resin-based castings and laminates. Suppliers of ancillary materials and equipment are also listed.

Control Transmitter Approved

ANNOUNCING that their 15CX4a synchro control transmitter has received M.o.S. type approval, Ketay, Ltd., state that they understand it is the first synchro transmitter produced in this country to receive such approval; and as it is matched to go with the Ketay 15CT4a synchro control transformer (which has also been M.o.S.-approved), there are now available two Size 15 machines which can together form the basis of a type-approved control servo system.

The 15CX4a has received type approval to EL1790 and the detail specification EL1726, Air Ministry stores ref. No. 5UD/6368. Some of its technical details are: weight, 6.4 oz; excitation frequency, 400 c.p.s.; nominal voltage rating, 115V; operating temperature range, −65 to +70 deg C.

IN BRIEF

We regret to record that Mr. S. M. Dyson, chief designer at the Rolls-Royce factory, East Kilbride, since July 1955, died recently. He joined the company in 1919 as a draughtsman.

* * *

After ten and a half years' service with K.L.M., latterly as senior captain on the Far Eastern services, Mr. J. C. Elmhurst-Baxter has joined the export sales department of the aero engine division of Rolls-Royce, Ltd., Derby.

* * *

Having been awarded a King George VI Memorial Fellowship, Mr. R. Prizeman has resigned as chief technician of Baynes Aircraft Interiors, Ltd., in order to study at the Graduate School of Business Administration in the University of California, Los Angeles.

* * *

Elliot Equipment, Ltd., have appointed Cory Brothers and Co., Ltd., as sole distributors in the U.K. of their inflatable life-saving equipment and other products, in addition to the appointment already held for overseas distribution. Under the new arrangement, two directors of Cory Brothers will be appointed to the Board of Elliot Equipment, and in addition Cory Brothers will play an important part in the financing (through Elliot Equipment) of sales of survival equipment of all types.

GATAC—believed to be the largest analogue computer in Europe in the hands of a private firm—is in use for study of the performance of Armstrong Whitworth's Sea Slug. Designed and built by E.M.I. Electronics, Ltd., to assist the M.o.S. in solving guided-weapon problems, it also has general applications in the study of complex non-linear control systems in such fields as chemical and nuclear engineering.

Additional plant costing an estimated £250,000 is to be installed by the Airscrew Co. and Jicwood, Ltd., at their Weybridge factory to produce an entirely new grade of Weyroc man-made timber. This new plant is expected to be in full production at the beginning of 1959.

* * *

Benson-Lehner (G.B.), Ltd., the new British subsidiary of the Benson-Lehner Corporation of Los Angeles, has taken over many of the functions of Benson-Lehner's British division at 12 Bargate, Southampton, Hants, and will continue the supply and maintenance of a wide range of data processing equipment, including analysers for strip chart records and ciné film and automatic graph plotters.

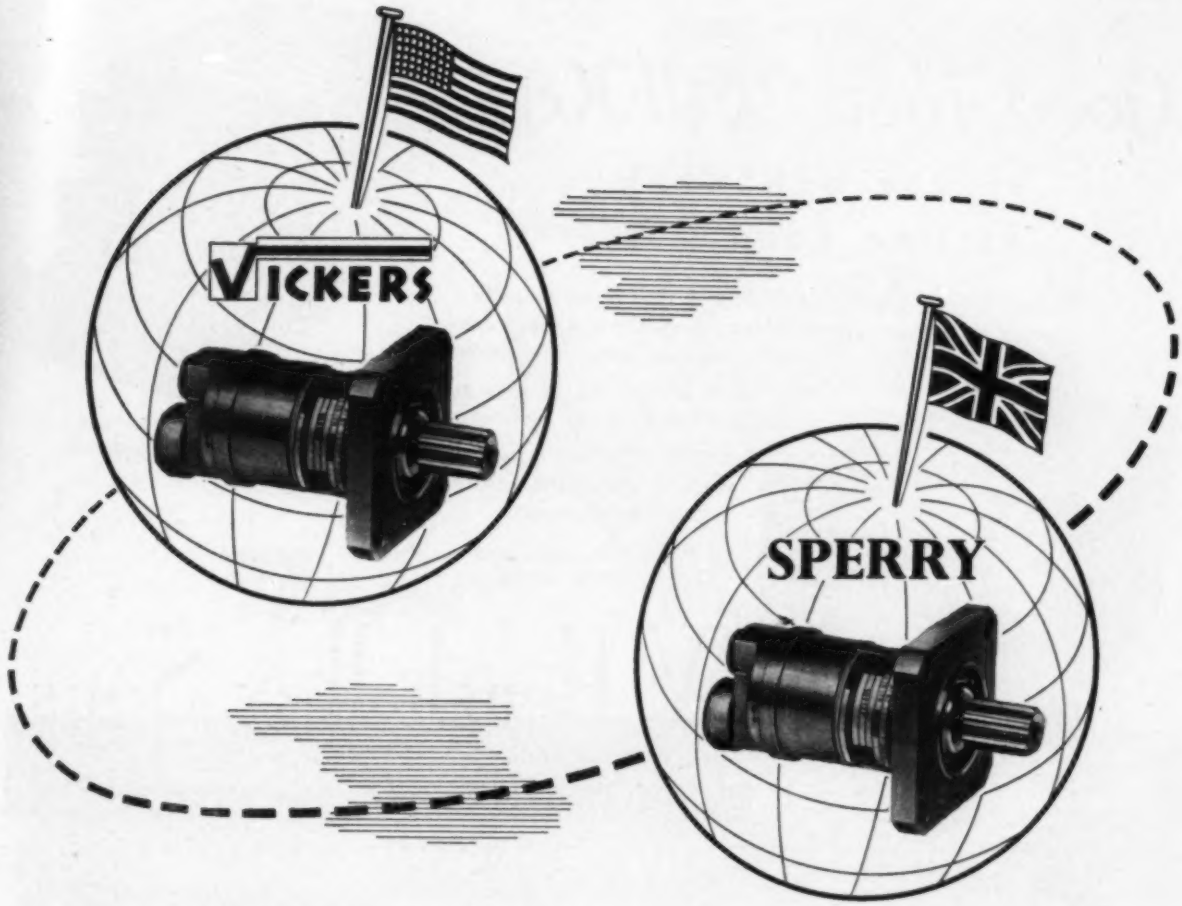
* * *

Recent appointments by Hunting Associates of Toronto include Mr. Robert Quigley as western aircraft sales manager of Field Aviation Co., Ltd., with headquarters at Calgary; and Mr. Albert Brown as manager of the eastern division of The Photographic Survey Corporation, Ltd., at 8375 Bougainville Street, Montreal.

* * *

The British Refrasil Co., Ltd., Stillington, Co. Durham, has published a brochure describing the properties and other aspects of Refrasil, which they say can play a part in solving "hitherto insolvable" high temperature electrical and thermal insulation problems. Among its aircraft applications are insulation blanketing on hot-air pipes in the Bristol Britannia, and cloth-covered blankets fitted to the fuel tank doors of Hawker Hunters.

Proteus exhaust shrouds for the Bristol Britannia (a Northeast Airlines' Series 305 is seen at Short's factory) fabricated in I.C.I. titanium by Joseph Lucas (Gas Turbine Equipment), Ltd., at their Burnley works. The outboard shrouds (17ft 6in long and of 4ft 6in diameter) weigh 117 lb and the inboard shrouds (22ft 6in) weigh 148 lb. This represents respective weight-savings of 60 and 66 lb in comparison with steel.



Combined resources

A great deal may lie between the flashpoint of original thought and the delivery of a finished product. To bridge this gap requires not only a fundamental understanding of the end to be accomplished, but the engineering facilities to accomplish the end. Here Sperry offer an unrivalled background of 40 years' technological advance plus the resources of famous precision engineering companies associated with them. Such a company is Vickers Incorporated of Detroit whose internationally famous Vickers Hydraulic Pumps and Motors for aircraft applications are now being manufactured by Sperry under licence in England.

HYDRAULIC PUMPS AND MOTORS · ELECTRO-HYDRAULIC VALVES · ACTUATORS · JACKS

associated with the electrical, electronic and mechanical servo systems and components which form an essential part of a complete automatic control system.

*** A technical service second to none is readily available to help solve your control problems—indeed you may find that Sperry already have such problems under active consideration.**

SPERRY hydraulic systems and components

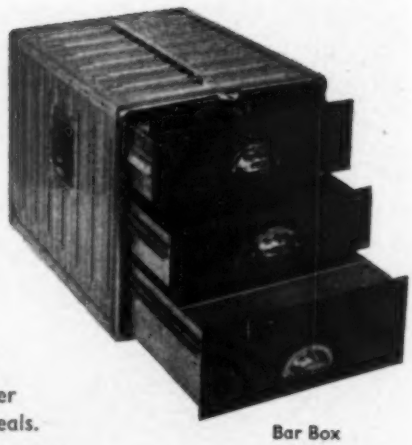
in association with Vickers Incorporated of Detroit whose products are manufactured in England under licence by Sperry.

SPERRY GYROSCOPE COMPANY LIMITED · GREAT WEST ROAD · BRENTFORD · MIDDLESEX. TELEPHONE: EALing 6771

K

Good Food–Well Kept

in the HENSHALL Airline Food Box



Bar Box Container

Over 1500 Henshall Food Boxes, specially designed for lightweight and robust construction are in use by the world's airlines.

The boxes provide the complete answer to the transport of passenger meals.

The Henshall Bar Box gives fully protected transport for bottles conforming to H.M. Customs Regulations.

Details of these products and also the new Henshall "Airfridg" Ice Box are available upon application.

Food Container

W. Henshall & Sons
(ADDLESTONE) LTD
AIRCRAFT ENGINEERS & SHEET METAL WORKERS
OYSTER LANE, BYFLEET, SURREY. Tel. Byfleet 2227-8. Grams Henstone Rly West Weybridge

---

Carter's

BRAIDING MACHINES

PRODUCE THE FINEST

AIRCRAFT FLEXIBLE METALLIC HOSES & TUBES FOR

- HIGH TEMPERATURES
- HIGH PRESSURES
- HYDRAULICS
- AIR BRAKES

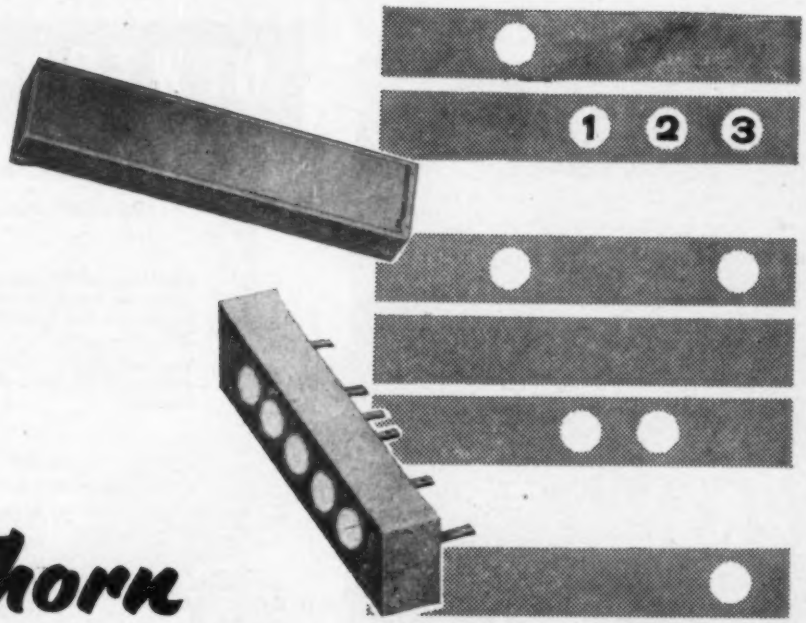
SEND **NOW** FOR CATALOGUE TO

B. & F. CARTER & Co., Ltd.
BOLTON · ENGLAND
Tel. BOLTON 4344
(PRIVATE EXCHANGE)

Manufacturers of:
ELECTRIC CABLE, BRAIDING AND WIRE-ROPE MACHINERY OF EVERY DESCRIPTION

PRESERVATION
PRE-PACKING
EXPORT-PACKING
SHIPPING and
INSURANCE

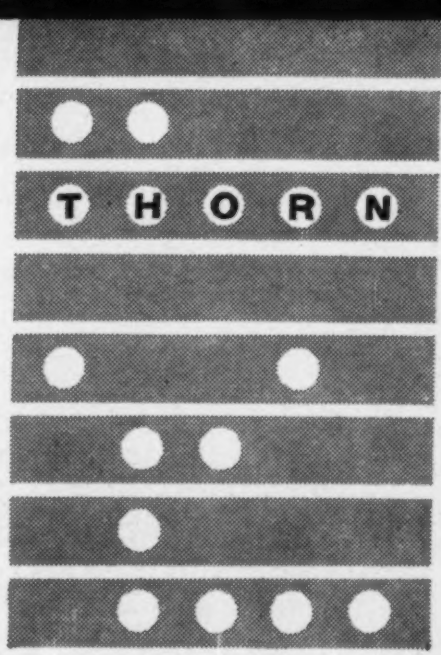
R. & J. PARK LTD.
DOMINION WORKS · THAMES RD · CHISWICK W4
PHONE: CHISWICK 7761
GRAMS: "PARKDOMIN CHISK"



Thorn

ANNOUNCE THE SUCCESSFUL PRODUCTION OF THE

ELECTROLUMINESCENT INDICATOR BLOCK with power pack (if required)



New · Space-saving · Economical

The essential component for MULTI-INDICATOR panels and banks of indicators

For those planning assemblies requiring banks or panels of illuminated indicators, here is the ultimate in simplification, space-saving and economy. The newly developed Thorn Electroluminescent block which has overall dimensions of only $2\frac{3}{16}'' \times \frac{1}{2}'' \times \frac{5}{16}''$ contains five electroluminescent areas each with its separate contacts. These blocks can be assembled in great numbers and only occupy a fraction of the present space utilised by lamp indicators.

POWER PACK Transistor power packs can be supplied as a complete installation if required.

Full information available now from:

AIRCRAFT COMPONENTS DIVISION · THORN ELECTRICAL INDUSTRIES LIMITED
GREAT CAMBRIDGE ROAD · ENFIELD · MIDDLESEX · TEL: ENFIELD 5340

PMENT
IRCRAFT
Since the early days of the first World War, British Thomson-Houston has specialised in equipment for aircraft. The experience gained over many years is incorporated in the design, development, and manufacture of complete electric power systems, ignition systems, engine-starting systems, and all associated components.
BRITISH THOMSON-HOUSTON
THE BRITISH THOMSON-HOUSTON COMPANY LTD.
COVENTRY, ENGLAND
Member of the AEI group of companies
A 4968

NEWTON-DERBY

HIGH FREQUENCY ALTERNATORS

400 to 2400 cycles per second

Our range of H.F. Alternators covers an extensive range of frequencies and outputs up to 30 K.V.A.

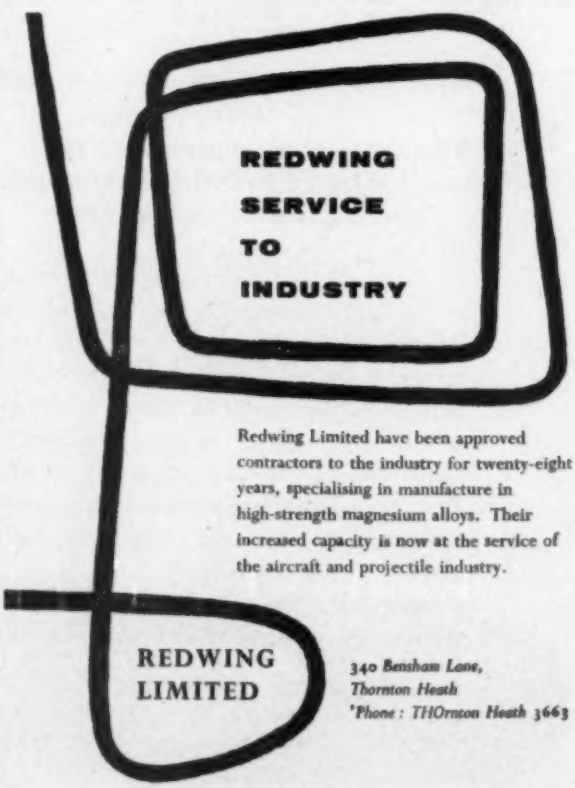
We would welcome your enquiries for this class of machine.

GIVE GENEROUSLY
R.A.F. BENEVOLENT FUND 67 PORTLAND PLACE LONDON, W.1.

Also manufacturers of:-

AUTOMATIC VOLTAGE REGULATORS
•
ROTARY TRANSFORMERS AND CONVERTERS
•
MOTOR GENERATORS

NEWTON BROTHERS (DERBY) LTD.
ELECTRICAL PLANT SPECIALISTS



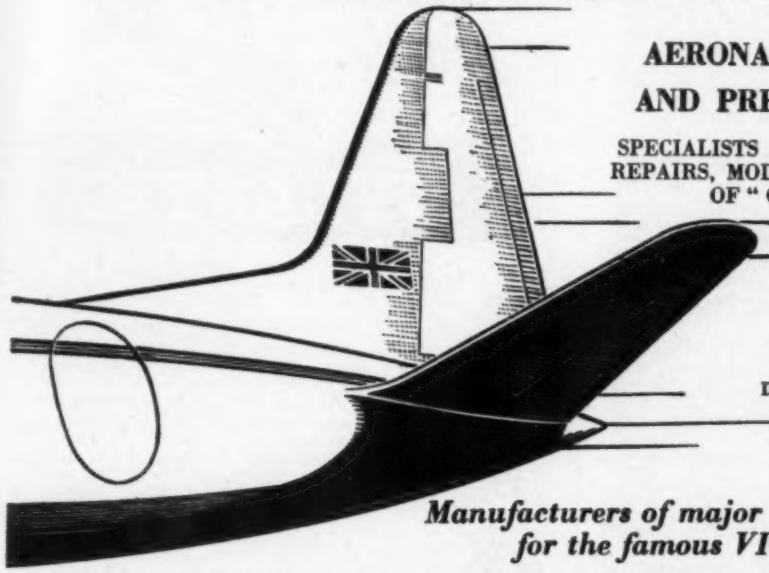
Redwing Limited have been approved contractors to the industry for twenty-eight years, specialising in manufacture in high-strength magnesium alloys. Their increased capacity is now at the service of the aircraft and projectile industry.

REDWING LIMITED

340 Bensham Lane, Thornton Heath
'Phone: THOrnton Heath 3663

SAMLESBURY ENGINEERING LIMITED

Main constructors of Mr. Donald Campbell's record breaking "BLUEBIRD"



AERONAUTICAL ENGINEERS AND PRECISION MACHINISTS

SPECIALISTS IN AIRCRAFT CONVERSIONS, REPAIRS, MODIFICATIONS AND ALL TYPES OF " C. of A." OVERHAULS.

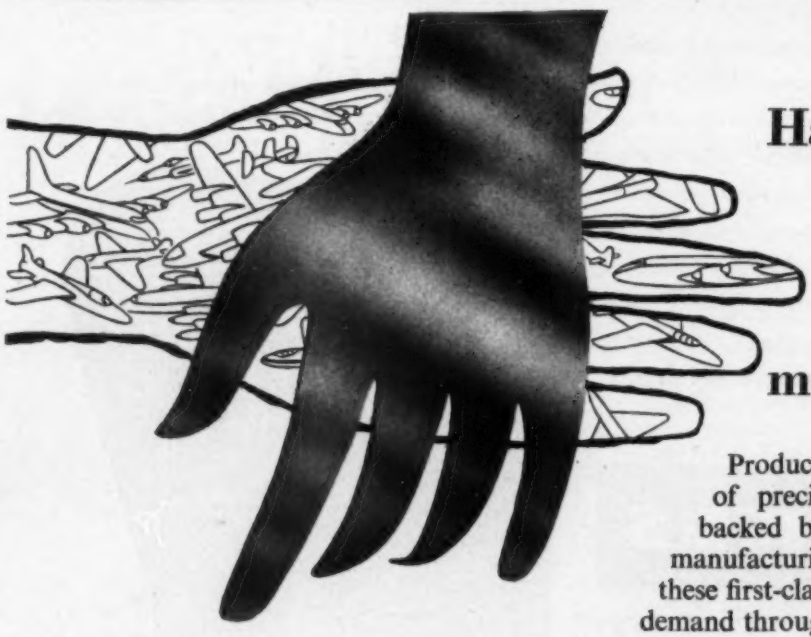
A.R.B. APPROVED DESIGN AND DRAWING OFFICE FACILITIES ALSO AVAILABLE FOR THE DEVELOPMENT OF NEW PROJECTS

Manufacturers of major assemblies and components for the famous VICKERS VISCOUNT

Suppliers of structural Assemblies, Jigs, Tools and Fixtures to the leading Aircraft Constructors.

SAMLESBURY AIRFIELD, NR. BLACKBURN
LANCASHIRE · ENGLAND
Tel: Blackburn 44668. Grams: "Croflite" Blackburn

ALSO AT STANSTED AIRPORT, ESSEX, AND SQUIRES GATE AIRPORT, BLACKPOOL.



Habershon Steel has a hand in most modern aircraft

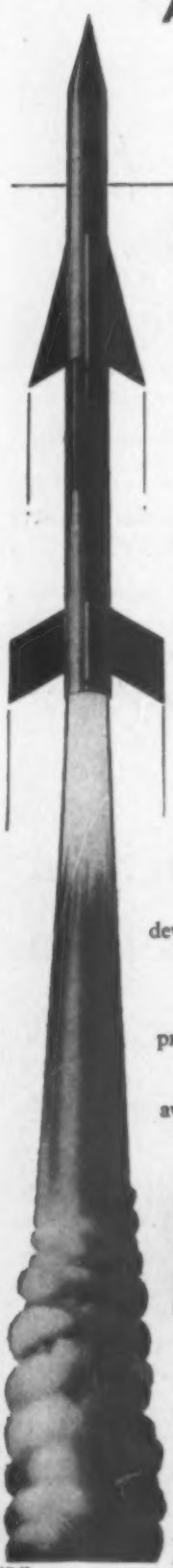
Produced to the highest standards of precision, Habershon steel is backed by more than a century's manufacturing experience. That is why these first-class products are in constant demand throughout the aircraft industry.

Habershon STEEL STRIP & SHEETS

mean quality in quantity

J. J. Habershon & Sons Ltd., Holmes Mills, Rotherham **Tel: 2081 (6 lines)**

OA. 4459



ACROSS NEW FRONTIERS

WITH VOKES

Probing out into space itself, man strives for yet higher altitudes, greater speeds and increased range. New breeds of aircraft—undreamt of a decade ago—scream upward in a constant race to cross yet new frontiers. British aviation is well to the fore in the world-search for new ideas, more power and ever increasing reliability. Supremacy in this latest field of endeavour is of vital importance and demands the best brains, materials and equipment. *Vokes* are taking an active part in ensuring maximum protection and efficiency for tomorrow's supersonic aircraft and missiles. *Vokes'* extensive research into filtration problems has pioneered new developments in the design and manufacture of filters for engine air intake, for lubricating oil, fuel, test beds, cabin pressurising and hydraulic systems. Today they continue to play a vital part in aviation's quest to cross yet new frontiers.

VOKES

Pioneers of Scientific Filtration

VOKES LIMITED
GUILDFORD · SURREY · ENGLAND
LONDON OFFICE
122 VICTORIA ST · WESTMINSTER · S.W.1

VOKES (CANADA) LTD. TORONTO
VOKES AUSTRALIA PTY. LTD. SYDNEY
REPRESENTED THROUGHOUT THE WORLD

V248

SAVE WEIGHT with . . .

PATENTED
NYLASTIC

ADJUSTABLE SUPPORT CLIPS

Light in weight this tough, flexible clip is outstanding for its resistance to abrasion and fatigue. Fully adjustable throughout its range, self-locking to facilitate rapid tightening down and radiused inner edges to eliminate cable chafing. Earthing and Non-Earthing 'P' type clips to S.B.A.C. specification.

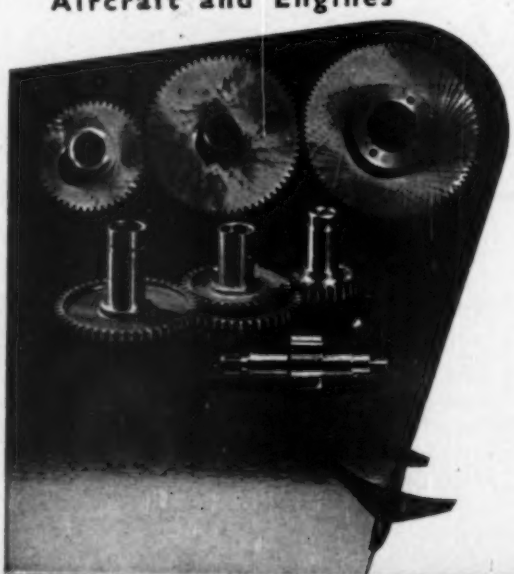
Available as Earthing, Non-Earthing and Rubber Sheathed types in 'P' and 'Saddle' form. Write for illustrated folder.

HOWARD CLAYTON-WRIGHT LTD

WELLESBOURNE · WARWICKSHIRE · ENGLAND
Telephone : Wellesbourne 316/7/8
Telegrams : 'Claytonrite', Wellesbourne

GEARS

and Components for Aircraft and Engines



S·E·OPPERMAN LTD
STIRLING CORNER, BOREHAM WOOD, HERTS., ENGLAND. Phone: ELSTREE 2021

The **Model 7** Universal

AvoMeter

Regd. trade mark

The world's most widely used combination electrical measuring instrument. Provides 50 ranges of readings on a 5-inch hand-calibrated scale fitted with an anti-parallax mirror. Guaranteed accurate on D.C. and A.C. up to 2 Kc/s to the limits laid down in B.S.S. 89/1954 for 5-inch scale-length industrial portable instruments.

The meter will differentiate between A.C. and D.C. supply, the switching being electrically interlocked. The total resistance of the meter is 500,000 ohms.

CURRENT: A.C. and D.C. 0 to 10 amps

VOLTAGE: A.C. and D.C. 0 to 1,000 volts

RESISTANCE: Up to 40 megohms

CAPACITY: ·01 to 20μFds.

AUDIO FREQUENCY POWER OUTPUT: 0—2 watts

DECIBELS: —25Db. to +16Db.

The instrument is self-contained, compact and portable, simple to operate and almost impossible to damage electrically. It is protected by an automatic cut-out against damage through severe overload.

Various accessories are available for extending the wide ranges of measurements quoted above.

List Price

£19 : 10s.

Size: 8 in. × 7½ in. × 4½ ins.
Weight: 6¼ lbs. (including leads)

● *Write for fully descriptive pamphlet*

Sole Proprietors and Manufacturers:— **AVO LTD.**

Formerly THE AUTOMATIC COIL WINDER & ELECTRICAL EQUIPMENT CO. LTD.
AVOCET HOUSE, 92-96 VAUXHALL BRIDGE ROAD, LONDON, S.W.1
Victoria 3404 (9 lines)

A7/6

KIGASS

HAND PRIMING PUMPS AND ATOMISERS FOR AIRCRAFT
[A.I.D./A.R.B. APPROVED]

* **PRECISION**
* **ACCURACY**
* **RELIABILITY**

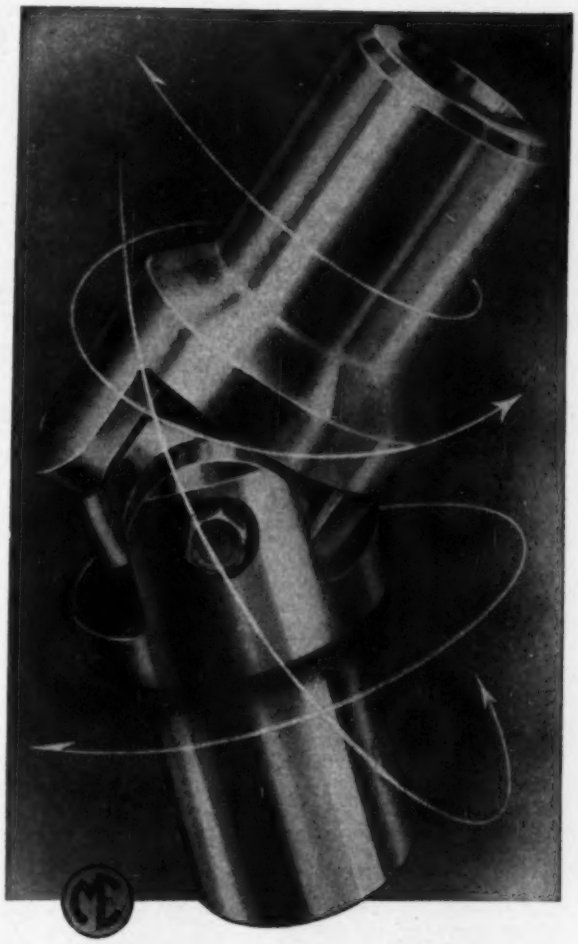
Widely used for engine starting. KIGASS are keeping pace with development in the production of low pressure atomisers having applications in Gas Turbine and Rocket Motors.

Manufacturers are finding fresh applications where the consistent output of the KIGASS PRIMERS are invaluable.

KIGASS

ARE KEEPING PACE WITH DEVELOPMENT

KIGASS LTD., 31 REGENT GROVE, LEAMINGTON SPA
Telephone: Leamington Spa 2480/1



angular motion faithfully transmitted

Light Series Universal Joints are available in special designs for aircraft use, made in light alloy to Spec. L.40 anodised, with hardened ground steel trunnion pins, cadmium plated. They are designed with shank diameters to suit bore of standard aircraft tube and will withstand moderate tension or compression loads. Made in a wide range of sizes, they can be supplied with covers as required.

Patent Universal ball Joint combines high load capacity, simplicity of design and 92-98% efficiency. (N.P.L. certified.)

Hooke's Type Universal joint is suitable for high speeds and is inexpensive to fit.

Grease Retaining Covers are available for all types and sizes of joints.

Air Ministry Gauge Test House Authority 89755/31

THE MOLLART ENGINEERING CO. LTD.
KINGSTON BY-PASS · SURBITON · SURREY · ENGLAND
TELEPHONE: ELMBRIDGE 0033-7 (5 lines) TELEGRAMS: PRECISION, SURBITON

"PANAX"

PAPER BASE LAMINATED SHEETS

96" × 48" upwards to 2½" thick

FOR AIRCRAFT JIGS AND TOOLS

RUBBER-DIE PRESS TOOLS
ROUTER TEMPLATES
DRILL PLATES
ASSEMBLY JIGS
HUFFORD STRETCHER
TOOLS AND JIGS

Advantages . . . Easy machining
Low cost · Long tool life · Service

TECHNICAL DATA, PRICES, ETC., FROM THE MANUFACTURERS

North British Plastics Limited

PATTERSON STREET, BLAYDON-ON-TYNE

Telephone: Blaydon 346/9. *Telegrams: "Panax" Blaydon.*

Leytool

MULTI-JAW SPANNER

(10 WAYS)

Patents No. 717181. Also World Patents

TEN SPANNERS IN ONE

Here is a most useful multi-purpose Spanner of original design. Accurately machined in high tensile steel to fit ten different nut sizes. Plated hand grips adjustable for use at each end or both at either end. Available in three different colour-coded models for Whitworth and B.S.F., Metric, or S.A.E. sizes.

19/9

All Leytools are entirely original and patented designs.
Write for free complete illustrated catalogue.

LEYTONSTONE JIG & TOOL CO., LTD.
LEYTOOL WORKS, HIGH RD., LEYTON, LONDON, E.10 *Phone Leytonstone 5022-4*
Specialists in Tooling Equipment and Machinery for every Industry

---

LAMINATED SHIMS

HALF THE WEIGHT · HALF THE TIME · HALF THE PRICE

RLA universally used and acclaimed by all engineers.
99% aluminium foil and tested up to a load of
20 TONS PER SQUARE INCH

STANDARD SHEET SIZES
18" × 18" and 18" × 6"

THICKNESSES
⅛ 1/32 ¼ 1/16 ⅛ 1/16

A.I.D. and A.R.B. Approved.

B. ATTEWELL & SONS LTD.

REFLECTION WORKS, THORNEY LANE : IVER, BUCKS

Telephone IVER 1102-3-4 · *Grams Reflection Iver*

BERYLLIUM COPPER

CRINKLE washers

Heat treated and plated giving corrosion resistance with high degree of recovery in relation to load and resistance to "set," Spring locking action suitable for electronic and instrument components. Size range ¼" to 8 B.H.

Prices and samples sent on request

CONTRACTORS TO THE ADMIRALTY · MINISTRY OF SUPPLY · & OTHER GOVERNMENT DEPTS.

DAVID POWIS & SONS LTD

FORWARD WORKS · SPARKBROOK · BIRMINGHAM 11 · PHONE VIC 1264-8

AIRCRAFT STRESS ENGINEERS

A major aircraft company requires the services of a number of junior and intermediate Stress Engineers. An engineering degree or a good H.N.C. is necessary plus some years practical experience, preferably in an aircraft stress office.

Initially, appointments are on the weekly staff in the salary range of £750-£900 p.a., but well qualified applicants can look forward to promotion to monthly staff status at an early date.

The vacancies are in London and selected candidates living in the provinces will be given assistance with re-housing and removal expenses.

Box AC 32735, Samson Clark and Co., Ltd., 57/61 Mortimer St., London, W.1.

ON THE "BRITANNIA"

SELECTIVE RELAY SWITCHES *for FATIGUE METERS*

Also differential and High Pressure Resistance transmitters combined with switch compatible with H.T.P.

CALIBRATOR MK II C up to 800 knots.

Differential pressure gauges for very light readings.

Airspeed indicators including MK 12A.

MUNRO

R. W. MUNRO LTD.
BOUNDS GREEN, LONDON, N.11 *Phone: Enterprise 4422*

AS ACTUAL MANUFACTURERS OVER 15 YEARS

We specialise

IN

ELECTRICAL CONNECTORS AND WIRING LOOMS

FULLY APPROVED BY A.I.D., A.R.B. AND D.I.E.M.E.
TEST GEAR AVAILABLE UP TO 10,000 VOLTS

Enquiries invited for any application

ERS

E.R.S. (LONDON) LIMITED
Brookwood Rd London S.W.18 Telephone Putney 3402/3/4

THE SPURLING STAIRWAY TO THE AIRWAYS

- Adjustable for use with all types of modern airliners.
- Height can be selected visually or can be preset.
- Mechanical operation throughout — no hydraulics to be affected by temperature changes.
- Can be knocked down for easy transportation.
- Full lighting equipment incorporated for all-night services.
- Complete stability in windspeeds up to 75 m.p.h.

ABRIDGED SPECIFICATION

HEIGHT RANGE: 6'3" to 10'7½" (upper assembly adjustable in multiples of 7½")
STEP TREADS: 11½" **STEP RISERS:** 7½"
STEP WIDTH: 2'10" (lower assembly) 2'5" (upper assembly)
WORKING LOAD: 20 average people
GROUND CLEARANCE: (Chassis): 7"
TURNING CIRCLE: 21'6"
OVERALL WEIGHT: 1450 lbs approx.

For full details of this and special stairways for Viking, Dakota and Ambassador, contact:

SPURLINGS

SPURLING MOTOR BODIES LTD.
Edgware Road, The Hyde, London, N.W.9., England · COLindale 7171
Cables: "SPURMOBO" HYDE, LONDON

FLIGHT and AIRCRAFT ENGINEER

PRESS DAY — *Classified advertisement "copy" should reach Head Office by* **FIRST POST THURSDAY** *for publication in the following week's issue subject to space being available.*

CLASSIFIED ADVERTISEMENTS

Advertisement Rates. 5/- per line, minimum 10/-, average line contains 6-7 words. Special rates for Auctions, Contracts, Patents, Legal and Official Notices, Public Announcements, Public Appointments, Tenders 6/- per line, minimum 12/-. Each paragraph is charged separately, name and address must be counted. All advertisements must be strictly prepaid and should be addressed to FLIGHT Classified Advertisement Dept., Dorset House, Stamford Street, London, S.E.1.

Postal Orders and cheques sent in payment for advertisements should be made payable to Iliffe & Sons, Ltd., and crossed & Co.

Trade Advertisers who use these columns regularly are allowed a discount of 5% for 13, 10% for 26 and 15% for 52 consecutive insertion orders. Full particulars will be sent on application.

Box Numbers. For the convenience of private advertisers, Box Number facilities are available at an additional charge for 2 words plus 1/- extra to defray the cost of registration and postage, which must be added to the advertisement charge. Replies should be addressed to "Box 0000, c/o Flight," Dorset House, Stamford Street London, S.E.1.

The Publishers retain the right to refuse or withdraw advertisements at their discretion and do not accept liability for delay in publication or for clerical or printer's errors although every care is taken to avoid mistakes.

AIRCRAFT FOR SALE

W. S. SHACKLETON, LTD.

Europe's Leading Aircraft Brokers

offer

BEECH D.18. Airframe 2,600. Pratt & Whitney Wasp Junior engines 82. Dual control, b/f panel, starter, nav. lights, 4-channel V.H.F., A.D.F., 12 months C. of A. £11,500.

G.A.L. CYGNET. Airframe 884. Cirrus Major III engine 110. Dual control, b/f panel, starter, nav. lights, screened engine. C. of A. 6.6.58. £1,100.

HANDLEY PAGE MARATHON IAs (2). Airframe 1,424, 1,678. Gipsy Queen 70-4 engines, 69, 253, 302, 217; 502, 502, 502, 184. Dual control, auto pilot, V.H.F., S.B.A., A.D.F., I.L.S. C.s of A. 12.7.58; 26.3.58. £50,000.

MILES MAGISTER. Airframe 2,090, engine 520. Dual control, V.H.F. instr. C. of A. 23.8.57. £450.

MILES MESSENGER. Airframe 1,499. Cirrus Major III engine, nil. Solo control, b/f panel, starter, 6-channel V.H.F., resprayed. C. of A. 17.4.58. October. £1,985.

PERCIVAL PROCTOR IV. Airframe 1,077, engine 513. Solo control, b/f panel, starter, nav. lights, C. of A. 20.6.60. £525.

PERCIVAL PROCTOR V. Airframe 1,041, engine 528. Solo control, b/f panel, starter, generator. 12 months C. of A. and respray. 2 months. £525.

PERCIVAL PROCTOR V. Airframe 550, engine 550. Dual control, b/f panel, starter, nav. lights, generator, V.H.F. C. of A. 28.1.60. £785.

PERCIVAL PROCTOR V. Airframe 341, engine 349. Dual control, b/f panel, nav. lights, starter, generator, 4-channel V.H.F. 12 months C. of A. Delivery 1 month. £650.

REID AND SIGRIST DESFORD. Airframe 107, Gipsy Major X engines 107, 107. Solo controls, 23-channel V.H.F. Electric starter. C. of A. 12 months. Prone camera position. 1 month. £2,500.

W. S. SHACKLETON, LTD., 175 Piccadilly, London, W.1. Cable: "Shackhud, London." Tel.: HYDe Park 2448-9. [0070

R. K. DUNDAS, LTD.

Offer Ex Stock

TWO medium Freight/Passenger/Survey Aircraft, easily adapted, economic in operation, and cheap to purchase.

TWO AVRO XIXs with 12 months C. of A. £4,150 each.

(a) ENGINES, Cheetah XV; port—nil, stbd.—236 hours. Airframe, 2,767. Radio: Bendix S.C.R. 259, Bendix BC 357, Murphy MR 80, Bendix R.A.F. 1589/99. Auto radio compass, 23 channel V.H.F., S.B.A. Metal tailplane. 9-10 seats. 12 months C. of A.

(b) ENGINES, Cheetah XV; port—nil, stbd.—508 hours. Airframe, 1,863. Radio: as for (a) plus Bendix B.C. 453; N/F receiver. Metal tailplane. 9-10 or 6-8 seats. Metal wings available extra if required.

BRIEF operating data: Useful load, 2,981 lbs.; range (6 passengers), 610 miles; take off, 50ft-700yds; landing, 570yds; cruising, 155 m.p.h.; stalling, 60 m.p.h.; climb, 750ft p.m.; ceiling, 19,000ft.

OUR many other aircraft available include, DC 3As at £47,000. Rapide IV, £4,350; Anson I, £1,500; Auster Autocrat, £1,200; Auster 5, £1,100; Percival Q6, 6-seater, from £1,700; Tiger Moth at £395 and many others.

R. K. DUNDAS, LTD., 59 St. James's Street, London, S.W.1. Tel.: HYDe Park 3717. Cables: "Dundas Aero," Piccy, London. [0559

FAIRCHILD ARGUS in exceptional condition, C. of A. until 20th July, 1958; airframe 397 hours, engine 175 hours. Price with two spare engines, £850. Mike Hawthorn Tourist Trophy Garage, Farnham, Surrey. Farnham 5363. [7054

AIRSPEED Consul containing 4 luxurious armchairs with adjustable headrests, occasional tables, heavy carpeting and contemporary upholstery. C. of A. issued this week. Engines low time since complete overhaul by the makers. Radio includes ARN.7 radio compass, STR.9X and CE.1140 twin V.H.F. Full dual and full blind flying. Aircraft can be inspected at Southend Airport without appointment. Contact T. D. Keegan, Limited, Southend Airport, Essex. [7051

DERBY AVIATION LTD.

Aircraft and Engine Overhaul

Sales — Service — Tuition

Scheduled and Charter Operators

DERBY AIRPORT

Telephone: ETWALL 323

Whatever you may require in the field of

LIGHT AEROPLANES

it is most likely that we can help you! At present we have FOR SALE most types including

AUSTER AUTOCRATS
MILES HAWK TRAINER
MILES GEMINI 1A & 3A

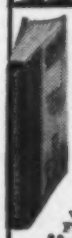
all available for inspection at Derby Airport.

Also we have several light engines in stock, including Cirrus Minor 2as and Major 3s.

Please note that our offices and flying school at Elstree Aerodrome (Telephone Elstree 3070) will be closed from 16th until 27th September inclusive.

LONDON OFFICE: Telephone: ABBEY 2345
78, BUCKINGHAM GATE, S.W.1.

FREE! TO AMBITIOUS ENGINEERS 144-PAGE BOOK



Full details of the easiest and quickest way to prepare for A.F.R.Ae.S., A.R.B. Licences, B.Sc.(Eng.), A.M.I.Mech.E., City & Guilds, and hundreds of Home Study Courses in all branches of Aeronautical, Mechanical & Electrical Eng., Draughtsmanship, R.A.F. Maths., etc., are given in this valuable book. Our Courses have been approved by Royal Aeronautical Society and many B.I.E.T. Students have obtained First Places in the A.F.R.Ae.S. Exams.

We definitely Guarantee

NO PASS—NO FEE

A copy of this enlightening Guide to well-paid posts will be sent on request—FREE! Write: B.I.E.T., 306a COLLEGE HOUSE, 29-31, WRIGHT'S LANE, LONDON, W.8.

BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY

OUR HELICOPTERS FLY ALL OVER THE WORLD

Our fleet of helicopters is at your disposal anywhere in the world, any time.
We also run a training school for pilots and engineers on Bell 47 and Sikorsky S55 helicopters. Ask for further details from:

OSTERMANS AERO, STOCKHOLM 7, SWEDEN
Cables: Ostermanaero, Stockholm

AIRCRAFT SPRING WASHERS

TO B.S. SPECIFICATION S.P.47

CROSS MFG. CO. (1938) LTD., COMBE DOWN, BATH

AIRCRAFT FOR SALE

BRISTOL FREIGHTER MARK 21

G—AHJD

AIRFRAME hours since new: 4,782. Engine hours since overhaul: 487 and 655. Propeller hours zero since overhaul. Major check IV and renewal of 12 months certificate of airworthiness just completed. RADIO V.H.F. STR.12C—I.L.S. SR.14/15C—Radio Compass SCR.269G—H.F. TR.1154/1155. Aircraft interior upholstered in green and cream and fitted with 52 Rumbold seats in green leather. In first-class condition throughout.

Delivery: Immediate.

Price: £35,000.

EAGLE AIRCRAFT SERVICES, LTD.

BLACKBUSHE AIRPORT

Camberley, Surrey.

Tel.: Yateley 2371 P.B.X. Cables: Eagle, Camberley. [7015

TRAVELAIR, LTD.,

offer

Private Executive and Commercial Aircraft

NEW AUSTER Alpha. £1,765.

PROCTOR IV, low hours, 12 months C. of A. £450.

RAPIDE Executive, full equipment and C. of A. £2,950.

TIGER MOTH, low hours, 3 years C. of A. £425.

H.P. terms arranged for all aircraft we sell.

Travelair, Ltd.

115 Oxford Street, London, W.1. GER. 3382. [0610

VENDAIR OF CROYDON AIRPORT

OFFER

GEMINI Mark IA. Airframe hours 1,050 since new. Cirrus Minor II engines 230 hours and 80 hours. V.H.F. radio. Recent C. of A.; aircraft in excellent condition. Price £1,900.

AUSTER Mark V. Airframe 850 hours since new, Lycoming engine zero hours since complete overhaul; three seats; new C. of A. Price £1,000.

FIVE other aircraft in stock. Vendair, Croydon 5777. [0603

AUSTER ALPHA JIN. Fitted with Gipsy Major engine, four seats. C. of A. valid until June, 1958. New upholstery. Colour silver and green.

APPLY Mitchell Aircraft, Ltd., The Airport, Portsmouth. Tel. 717641. [0348

PIPER AIRCRAFT. Tri-Pacers—Apaches—Super-Cubs. The sole agents for Great Britain and Ireland are Irish Air Charter Limited, 62 Merrion Square, Dublin. Tel. 63297. [0200

PROCTOR Mk. 3. Comp. overhaul. 3 year C. of A. Double rear seat. Very clean and sound aircraft. Silver and red finish. Two weeks delivery, £475 o.n.o. Box No. 1667. [7075

LOCKHEED 12A EXECUTIVE. Formerly on British Register; excellent condition; fitted four passenger seats, separate crew (2) compartment, toilet; R.985 engines, 2 D.30 props, 24 volt, full radio, Sperry auto-pilot, long-range tanks. Under 3,000 hours since new 1939. C. of A. April, 1958. Adequate range spares including one engine, two props, two mainplanes. Full detailed specification available. Aircraft at present Australia; owners will provide independent survey reputable assessors. Enquiries and offers invited. British Aviation Services, Limited, 1 Great Cumberland Place, W.1. Ref. GTA. [7009

AIRCRAFT WANTED

OUR demand for good used aircraft of all descriptions is very great. Operators or owners wishing to dispose of aircraft, engines, or anything aeronautical are asked to communicate at once to:

R. K. DUNDAS, LTD., 59 St. James's Street, London, S.W.1.

HYDE PARK 3717. Cables: "Dundasaero, Piccy, London." [0558

PARMAN AIRCRAFT SUPPLIES LIMITED

P A S

Service... to aviation

FROM STOCK

ELECTRICAL EQUIPMENT

RADIO

ELECTRONICS

INSTRUMENTS

HYDRAULICS

In fact everything used in the construction and maintenance of aircraft

We probably stock your requirements

PARMAN AIRCRAFT SUPPLIES LTD.

A.I.D. Approved A.R.B.

PARMAN HOUSE, BALCOMBE ROAD, HORLEY, SURREY

Telephone: HORLEY 4344 (P.B.X.)

Telegrams: Parmanair, Horley, Surrey

AIRCRAFT ACCESSORIES AND ENGINES

ROLLASON AIRCRAFT AND ENGINES, LTD., CRO. 5151. For all Tiger Moth, Gipsy Major, Gipsy Queen and Gipsy Six Spares. Specialists in the overhauling of Gipsy engines. [0131

AIRFRAME spares for Dakota, Harvard, Piper Cub, Fairchild "Argus," Beechcraft D.17S, Mosquito, Spitfire, Firefly. Engine spares for Pratt & Whitney, Armstrong Siddeley, Lycoming, etc. Accessories and instruments for all types of aircraft. A. J. WALTER, Gatwick Airport, Horley, Surrey. Tel.: Horley 1420 and 1510 (Ext. 105/6). Cables: Cubeng, London. [0268

PHILLIPS & WHITE, LTD., offer from stock Instruments and instrument parts. Navigational equipment, electrical components, airframe parts and hydraulic components and parts. Engine spares for de Havilland Gipsy Major and Queen series, also Armstrong Siddeley Cheetah IX, X, XV spares. Stock lists available. 61 Queen's Gardens, London, W.2. Tel.: Ambassador 8651, 2764. Cables: Gyrair, London. [0466

AIRCRAFT ACCESSORIES AND ENGINES WANTED

WYLLAN EQUIPMENT CO. require Lycoming 4-cylinder engines and spares, also wide range of spares and components of U.S.A. origin. 222 Waterloo Road, Manchester 8. Tel.: Broughton 4182. Grams.: Wyllavia. [0260

AIRCRAFT SERVICING

REPAIRS and C. of A. overhaul for all types of aircraft.—Brooklands Aviation, Ltd., Civil Repair Services, Sywell Aerodrome, Northampton. Tel.: Moulton 3251. [0307

AIR CHARTER

HELICOPTER charter. Machines available U.K. and overseas.—Autair, Ltd., 75 Wigmore Street, London, W.1. Tel.: Welbeck 1131. [0021

AERIAL PHOTOGRAPHY

MORSE Film Developing Units and Film Dryers; Continuous Film Printers; Argon and Mason Contact Printers; Water Supply Kits; Glazing Machines; F.24 Spiral and Spool Developing Outfits; K.17; F.52; F.49; and F.24 Cameras, Mounts, Lenses, Magazines, Controls, Vacuum Pumps, Motors and Spares for above Cameras; 16 m/m and 35 m/m Cameras, Projectors and Spares. Also large quantity of Aerial Film (all sizes). A. W. Young, 47 Mildenhall Road, London, S.5. Tel.: AMHerst 6521. [0290

AGENTS

THE TIGER MOTH SPECIALISTS are still Rollason Aircraft and Engines, Ltd., of Croydon Airport. Tel.: CRO. 5151. [0134

CLUBS

SURREY Flying Club, Croydon Airport, M.C.A. approved for Private Pilots' Licences. Link trainer instruction available. Open seven days a week. Croydon 9126. [0292

HERTS AND ESSEX AERO CLUB, Stapleford Tawney Aerodrome. M.C.A. approved private pilot's licence course. Auster, Gemini and Tiger aircraft. Trial lesson 35s. 15 miles centre of London. Central Line Underground to Theydon Bois, bus 250 to club. Open every day.—Tel.: Stapleford 210. [0230

PLYMOUTH AERO CLUB. Course approved for Private Pilots' Licence. Auster and Tiger Moth aircraft £3 7s. 6d. per hour, reduced solo rates for contract hours. Gemini and Messenger aircraft also available. Instructors' courses, charter flying, pleasure flights. Comfortable club house. Roborough Aerodrome. Tel.: Plymouth 72752. [0341

CONTACT LENSES

MODERN CONTACT LENSES CENTRE 7(D.1), Endsleigh Court, W.C.1. Deferred Terms. Booklet sent. [0342

FOR SALE

QTY. 6—STR9X Transmitter/Receivers. A.R.B. Released. Ex stock.—Staravia, Blackbushe Airport, Camberley. [0296

PACKING AND SHIPPING

R. AND J. PARK, LTD., 143/9 Fenchurch St., E.C. Tel.: Mansion House 3083. Official packers and shippers to the aircraft industry. [0012

Field's comprehensive aircraft service

includes

Propeller, Engine and Airframe Spares

FOR

DOUGLAS DAKOTA C47 A & B AIRCRAFT

Please address your inquiries to:

SPARES SERVICE DEPARTMENT

CROYDON AIRPORT

SURREY

Field

AIRCRAFT SERVICES LIMITED

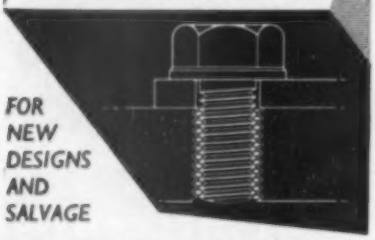
72 WIGMORE STREET · LONDON W.1

Tel: WELbeck 7799

Cables: 'FIELDAIR', WESDO, LONDON

J.A.L. 111

WIRE
THREAD
INSERTS



FOR NEW DESIGNS AND SALVAGE

CROSS MFG. CO. (1938) LTD
COMBE DOWN, BATH
TEL: COMBEDOWN 2355/8

MARSHALL
AIRPORT WORKS CAMBRIDGE

REQUIRED FOR "ON SITE"

SKILLED AIRFRAME FITTERS

Generous Allowances

Good Average Earnings

Write, Call or Phone
Cambridge 56291—Ext. 36
EMPLOYMENT OFFICER

THE
FAIREY AVIATION CO. LTD.
An
AERONAUTICAL ENGINEER

specialized in Aerodynamics or Aircraft Structures is required for our Special Projects Division at Salisbury, South Australia. A degree in Aero. Engineering or equivalent is essential and at least five years' experience in industry or research and/or development organization is desirable. Salary in region of £A1,250 p.a.

Please apply to the

Personnel Manager,
The Fairey Aviation Co., Ltd.,
Hayes, Middlesex.

PATENTS

THE proprietors of British Patent No. 709,490, "Improvements in Emergency Escape Apparatus for Aircraft Pilots and/or other occupants" desire to secure commercial exploitation by licence or otherwise in the United Kingdom. Enquiries should be addressed to F. J. Cleveland and Co., 29 Southampton Buildings, Chancery Lane, London, W.C.2. [7069

PUBLIC ANNOUNCEMENTS

AIR TRANSPORT ADVISORY COUNCIL

THE AIR TRANSPORT ADVISORY COUNCIL give notice that they have received the undermentioned applications to operate scheduled air services:—

APPLICATION No. 1442 from Independent Air Travel Ltd., at Bournemouth (Hurn) Airport, Christchurch, Hants, for a Vehicle Ferry Service with Bristol 170 aircraft for the carriage of vehicles, supplementary freight and incidental passengers between Bournemoth (Hurn) and Cherbourg (Maupertus) at a frequency of up to five services per week from 11th October to 31st March each year and up to 25 services from 1st April to 10th October each year, increasing to 35 services per week according to demand, for a period of seven years from 1st November, 1957.

APPLICATION No. 792/2 from Skyways Ltd., of 7, Berkeley Street, London, W.1, for an amendment to the terms of approval of the Normal Scheduled Service which they are authorised to operate on the route Lympne-Vichy and/or Valence (or Lyons for Valence) until 28th September, 1963, so as to permit the service to terminate at Lyons without the present restriction regarding the onward carriage of passengers by coach to Valence and points to the south; an increase of frequency from four return flights weekly to five return flights daily and an extension of the period of approval to October, 1964.

FROM DRAGON AIRWAYS LTD., of 1, Great Cumberland Place, London, W.1:—

APPLICATION No. 90/3 for an amendment to the terms of approval of the U.K. Internal Service which they are authorised to operate between Newcastle and Manchester with Dakota, Viking and Heron aircraft until 31st March, 1960, so as to operate instead between Newcastle and Blackpool with Dakota, Bristol 170 and Heron aircraft.

APPLICATION No. 95/3 for an amendment to the terms of approval of the Normal Scheduled Service which they are authorised to operate on the route Newcastle-Brussels (optional)-Zurich with Dakota and Viking aircraft until 31st March, 1960, so as to operate instead on the route Newcastle-Leeds (Yeadon) (optional)-Brussels and/or Zurich, with Dakota and Bristol 170 aircraft.

APPLICATION No. 703/1 from British European Airways Corporation of Keyline House, Ruislip, Middlesex, for an amendment to the terms of approval of the Normal Scheduled Service which they are authorized to operate on the route London Airport-Dusseldorf and/or Munich and/or Vienna-Belgrade-Athens optional)-Istanbul optional)-Cairo optional) until 31st March, 1963, so as to permit the inclusion of an optional traffic stop at Zurich or Geneva.

THESE applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on 30th July, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3, Dean's Yard, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. [7065

TUITION

AIR-SERVICE TRAINING

The only fully equipped private School of Aviation. Specialist staff, comprehensive equipment and full residential and recreational facilities within the School ensure the soundest training for an aviation career.

M.T.C.A. APPROVED COURSES

for private and commercial pilots' licences and maintenance engineers' licence in categories "A" and "C".

HELICOPTER COURSES

for private and professional licences. Details available from the Commandant.

AIR SERVICE TRAINING, LTD.

Hamble, Southampton. Tel.: Hamble 3001/9.

[0970

A SUCCESSFUL career for your son.

AERONAUTICAL, technical and practical training for all branches of aeronautical engineering. Diploma course leads to executive appointments in civil aviation design and development, draughtsmanship, maintenance, etc. Extended courses to prepare for A.F.R.Ae.S., and A.M.I.Mech.E. examinations. Write for prospectus to Engineer in Charge, College of Aeronautical Engineering, Chelsea, London, S.W.3. FLAxman 0021.

[0019

MARSHALL
AIRPORT WORKS CAMBRIDGE

VACANCIES AT CAMBRIDGE
for
SKILLED AERO ELECTRICIANS

Required for installation and testing Electrical Systems in Civil and Service Aircraft. Also

SKILLED AIRFRAME FITTERS

Good Average Earnings.
Single Lodging Accommodation Available

Write, Call or Phone:
Cambridge 56291—Ext. 36
EMPLOYMENT OFFICER

THE DE HAVILLAND AIRCRAFT CO. LTD.
BROUGHTON, CHESTER

STRESS ENGINEER

Man qualified in Aircraft Stress Analysis required for progressive post.

Excellent prospects for the man with initiative.

Pension and Superannuation Scheme.

Sports and Social facilities.

Apply in first instance for interview, quoting reference DC61/F, to the Personnel Manager, or telephone Chester 24646, Ext. 34.

MINISTRY APPROVED COURSES FOR
COMMERCIAL PILOT INSTRUMENT RATING

All subjects for professional licences and ratings including Academic, Technical, simulated and practical flying. Home-study excellent alternative.

• Individual coaching • Refresher Courses
• Officially appointed by the Institute of Army Education for Joint Correspondence Scheme

Full details from your Station Education Officer, or
London School of Air Navigation Ltd.
11 Ovington Sq., Knightsbridge, London, S.W.3
KEN 8221 Fiery Bush, Croydon Airport

R.A.F. OFFICERS
UNIFORMS
LARGE SELECTION IN STOCK
NEW AND RECONDITIONED
FISHERS, 86/88 WELLINGTON ST.
WOOLWICH, S.E.17 'PHONE 1855

TUITION

CIVIL PILOT/NAVIGATOR LICENCES

AVIGATION, LTD., provides full-time, or intermittent instruction and postal tuition, or a combination of any of these methods to suit individual requirements for the above licences. Classroom instruction can be provided for A.R.B. General, certain Specific Types and Performance Schedule examinations. Link training Dept. at MONarch 1364.

FOR full details apply to The Principal.

AVIGATION, LIMITED

30 Central Chambers, Ealing B/Way, London, W.5. Tel.: Ealing 8949. [0248

A.F.R.Ae.S., A.R.B. Certs., A.M.I.Mech.E., etc., on "no pass, no fee" terms. Over 95 per cent successes For details of exams. and courses in all branches of Aeronautical work, Navigation, Mechanical Engineering, etc., write for 144-page handbook—free.—B.I.E.T. (Dept. 702), 29 Wright's Lane, London, W.1. [0707

FREE! Brochure giving details of courses in all branches Aero Engineering covering A.F.R.Ae.S., M.C.A. exams, etc. Also courses for all other branches of engineering. Write: E.M.I. Institutes, Dept. F26, London, W.4. (Associated with H.M.V.) [0964

AIR TRAVEL CASES

Fitted to take several suits on their hangers without creasing, plus your entire holiday kit. Size 18" x 24" x 8". Made in beautiful quality waterproof canvas, fully zipped. Owing to tremendous purchase

Also ex.W.D. Grade 1 35/-

BRAND NEW ONLY 69/11

P. & P. 2/6

JET FLYING SUITS

Smartest Garment on the "Bike." Made in super quality R.A.F. Blue Windproof Poplin. Superlatively showerproof. Part worn.

P. & P. 1/9. **25/-**

Brand new "long" type **SHEEPSKIN LINED FLYING JACKETS**

In black or brown, with belt and superior quality thick pile white sheepskin lining. State size.

P. & P. 2/6. **£6/10**

Also brown leather, heavy fur-lined ex-W.D. **FLYING TROUSERS**

Fully zipped. Brand new

P. & P. 2/6. **99/6**

Cash, Cheque or P.O. with order. C.O.D. 1/- extra. Satisfaction or money refunded.

NORTHERN MAIL ORDER CO.

(Dept. F2) 183 LEITH WALK, EDINBURGH, 6

Mullard—Pressed Steel—G.E.C.

24 repeat orders

33 MACHINES

Over the years 10 Murad Dustless Grinders have been installed by Mullard, 8 by G.E.C., and no less than 15 by Pressed Steel. There could be no finer tribute to the machine.

The Murad Dustless Grinder is unique. It embodies its own dust inhibitor rendering separate dust extraction plant unnecessary. It can be placed anywhere in the shop to suit the sequence of operations without endangering the slides of nearby precision machines. Murad Dustless Grinders are found in the machine shops of the Industrial Giants. Follow the lead of the leaders of British Industry and send for full details NOW!

Model E.G.8: 8" dia. wheels. Model E.G.16: 16" dia. wheels. Pat. Nos. 674,740.

Murad

DUSTLESS GRINDER

KEEPS ITS DUST TO ITSELF!

MURAD DEVELOPMENTS LTD.

Stocklake, Aylesbury, Bucks. Tel: 2691

TUITION

LEARN to fly, £30; Instructors' Licences and Instrument flying, for £3 10s. per hour. Night flying £5 per hour. Residence 6 guineas weekly. Approved M.C.A. Private Pilots' Licence course. Specialized course for Commercial Pilot's Licence.—Wiltshire School of Flying, Ltd., Thruxton Aerodrome (Andover Junction 1 hour 15 minutes from Waterloo), Hants. [0253

SOUTHEND-ON-SEA Municipal Air Centre and Flying School. Comprehensive training for all pilots' licences, ratings and endorsements. Special facilities for instrument, night-flying and commercial pilot licences. Chipmunk aircraft. Link training to full instrument rating standard. No entrance fee or subscriptions. M.T.C. approved 30-hour course. Municipal Airport, Southend-on-Sea, Essex. Rochford 56204. [0453

SITUATIONS VACANT

NORTHAMPTON COLLEGE OF ADVANCED TECHNOLOGY, LONDON,

St. John Street, E.C.1.

APPLICATIONS are invited for posts in the Civil and Mechanical Engineering Department, for teaching in courses leading to the University degree in Engineering, Diplomas in Technology and Higher National Certificates as follows:

LECTURER in Aeronautical Engineering subjects, including any of the following: Aerodynamics, Aircraft Structures and Design, Mechanics of Flight.

LECTURERS in Civil and Mechanical Engineering subjects, including any of the following: Strength of Materials, Mechanics of Machines, Applied Thermodynamics, Mechanics of Fluids.

ASSISTANT Lecturers (Grade B) in general subjects of Civil, Mechanical or Aeronautical Engineering. One assistant will be required mainly in connection with Engineering Drawing.

SALARY scales: Lecturer, £1,236 rising to £1,398 p.a.; Assistant Lecturer (Grade B), £686 rising to £1,073 p.a., with additions for qualifications, training and industrial experience.

FURTHER particulars and forms of application are obtainable from the Secretary, to whom applications should be sent not later than 30th September.

J. S. TAIT,
Ph.D., B.Sc.(Eng.), M.I.E.E.,
Principal. [7036

LEO COMPUTERS, LTD.

Training to be

COMPUTER ENGINEERS

YOUNG men with G.C.E. "A" in physics and mathematics (or equivalent), without engineering experienced, are offered

OPPORTUNITY TO TRAIN AS ELECTRONIC COMPUTER ENGINEERS

THIS is an excellent opportunity for anyone who has completed National Service (or will do so during 1957) to train from scratch to reach position of responsibility in this rapidly-expanding field. The next training course begins at the end of October.

APPLICANTS should write, giving personal and educational details, and an outline of any experience to:

THE PERSONNEL OFFICER,
Leo Computers, Ltd.,
38/42 Minerva Road,
Park Royal, London, N.W.10. [6999

CHIEF Planning Engineer. Applications are invited from suitably qualified engineers in machining, sheet metal and main and detail fitting to take charge of department in a growing division of well-known company in West Surrey. Salary from £1,500 according to experience and qualifications. Write in strictest confidence to Managing Director. Box No. 1664. [7072

SITUATIONS WANTED

B.E.A. HAVE VACANCIES IN THEIR

Project and Development Branch for

1 AN ASSISTANT Performance Engineer. Duties will include assisting in the calculation and analysis of performance for the preparation of operational data and the planning of flight handling techniques. Assisting in the recording and analysis of routine and special flight test data and in planning and carrying out test programmes. Qualifications: education to degree standard in aeronautical engineering, experience in aerodynamics or flight test work; flying experience as pilot desirable. Salary: £910-£1,085 or £1,025-£1,250 per annum according to qualifications and experience.

2 A TECHNICAL Assistant. Duties will include collecting and maintaining records of performance and operating economics of civil aircraft and assisting in their evaluation. Qualifications: University degree or equivalent in engineering or allied subject. Salary: £807 10s.-£857 10s. or £832 10s.-£970 p.a. according to qualifications and experience.

APPLICATIONS to Senior Personnel Officer, Engineering, British European Airways Engineering Base, London Airport, Hounslow, Middlesex [7068

Did you visit Auster's Stand at the S.B.A.C. SHOW?

If so, you will, no doubt, have seen the interesting range of aeroplanes we are now designing and producing.

If work of this type appeals to you, we have vacancies for:—

SENIOR STRESSMEN

and

SENIOR DESIGN DRAUGHTSMEN

in our modern Design Offices at

REARSBY, NR. LEICESTER

and

FARNBOROUGH, HANTS.

We can offer excellent opportunities and a high salary for suitable candidates. Company Pension Scheme in operation.

Applications should be made to the

Personnel Manager,
Auster Aircraft, Ltd.,
Rearsby, Leicester,
or by telephone
to Rearsby 321 or Farnborough 227.

BROOKLANDS AVIATION LIMITED

require

AIRCRAFT ELECTRICIANS

with experience on CANBERRA AIRCRAFT

PIECEWORK BONUS — CANTEEN FACILITIES

Apply in first instance to:—

No. 2 SITE, BUTTOCKS BOOTH, MOULTON, NORTHAMPTON

DESIGNERS
DRAUGHTSMEN
ENGINEERS
TECHNICIANS

Men with the right capabilities and qualifications are required for a programme of work on the design and development of high performance and supersonic aircraft.

Depending upon the appointment an Ordinary or Higher National Certificate, Degree or equivalent qualification is required. Previous experience of aircraft work is preferred but is not essential.

A new design office, laboratories, and wind tunnel will be completed in the near future and the posts advertised present opportunities to enter a strong design team with excellent working conditions in pleasant surroundings.

AERODYNAMICS Performance, Stability Control.
STRENGTH CALCULATIONS Static and Dynamic stressing and design calculations, fatigue, aeroelasticity.
SERVOMECHANISMS Electrical-mechanical aerodynamic control systems.
FLUTTER AND DYNAMICS Calculations and Test analysis involving use of analogue and digital computers.
STRUCTURAL TEST Static and Dynamic Testing including heat effects of components and complete airframes.
SYSTEMS TESTING Functional and reliability testing of air, hydraulic, fuel and electrical systems.
STRUCTURES DESIGN Detail design of aircraft structural components.
SYSTEMS DESIGN Detail design of hydraulic, fuel, and air systems.
ELECTRICAL ELECTRONIC INSTALLATIONS Design of installations of radio, navigational and other military equipment of latest types and specifications.

Write giving full particulars, quoting ref. number 3445 to:—

Personnel Officer,

VICKERS-ARMSTRONGS (AIRCRAFT) LTD South Marston Works, Nr. Swindon, Wilts.

T3421

D. NAPIER & SON, LTD.

FLIGHT DEVELOPMENT ESTABLISHMENT,
LUTON AIRPORT, BEDS.

SENIOR STRESSMEN
for interesting projects on both British and American aircraft. Must have H.N.C. or equivalent and preferably with aircraft experience.

WEIGHTS ENGINEERS
to work in conjunction with the above. O.N.C. and aircraft experience desirable.

AERODYNAMICISTS
for flight test and future project analysis. Experience on problems of stability and control, and/or thermodynamics an advantage. Degree or equivalent standard desirable.

Interviews can be arranged in Luton or London.

Write initially with full details to:
Dept. C.P.S., 336/7, Strand, W.C.2,
quoting Ref. F 810G.

ENGLISH ELECTRIC COMPANY LTD

AIRCRAFT DIVISION

DESIGNER DRAUGHTSMEN

with four or more years experience in any aspect of aircraft design, are invited to apply for posts at Warton and Acton.

The Division is a strong, well balanced team; a fact which has been amply demonstrated by the established success of the Canberra, and further emphasized by the reports on the P.1 in the Technical and National Press. Additional recruitment of experienced men for the drawing offices is now required to help our extensive long-term commitments.

The work available now, and for the future, is on advanced military aircraft, and a civil aircraft research team is now being established.

Excellent new drawing offices are being built at Warton and will be occupied shortly.

Apply, giving full details, to the

Chief Personnel Officer,
c/o Department C.P.S., Marconi House,
336/7 Strand, London, W.C.2,
quoting reference number: F1799D.

BEA

BRITISH EUROPEAN AIRWAYS

require

LICENSED AIRCRAFT ENGINEERS

who possess 'A' and/or 'C' licences on modern transport aircraft, to act as Outstations Engineers in the U.K. and on the Continent.

Consideration given to applicants who have had maintenance experience on

(a) *aircraft currently operated by the Corporation;*

(b) *Constellation 749 and 1049 or Argonaut aircraft.*

Salary £837 19s 3d rising to £969 13s 3d p.a. plus Station Allowances, including additional payments for wife and children and education allowances for children where applicable.

Applications to

Senior Personnel Officer,
Area and Outstations,
BRITISH EUROPEAN AIRWAYS
Keyline House, Ruislip, Middlesex

WEIGHT ENGINEER

A vacancy exists for a senior Weight Engineer to be engaged primarily on weight analysis and research duties. Some experience in project weight engineering is essential and an educational standard of H.N.C. (or equivalent) is required.

The successful candidate, who will deal with problems associated with high performance aircraft, can be assured of interesting and varied work demanding considerable personal initiative.

Write giving full particulars and quoting reference No. 3503 to the

Personnel Officer,
Vickers-Armstrongs (Aircraft) Ltd.,
South Marston Works,
Nr. Swindon, Wilts.

SITUATIONS VACANT

Westland Aircraft, Ltd., Yeovil,

require

SENIOR AIRCRAFT TECHNICAL WRITERS

as follows:

ONE experienced in the initiation and preparation of airframe major repairs.

ONE experienced in gear transmission writing, preferably in helicopter transmissions. Additional experience in reconditioning procedure desirable.

TWO experienced in aircraft electrical, radio and radar writing to M.O.S. and A.R.B. standards.

TWO experienced in general writing of M.O.S. and A.R.B. Manual covering aircraft components and systems.

AN electrician is also required with experience in the preparation of aircraft electrical, theoretical and routing diagrams.

APPLICATIONS, stating age, experience and salary required, are to be addressed to the Personnel Manager, Westland Aircraft, Ltd., Yeovil, Somerset. [6989

HUNTING PERCIVAL AIRCRAFT LIMITED

require

a

TECHNICAL Author for the compilation of aircraft type records and stress office data sheets.

APPLICANTS should preferably have had previous writing experience, and be conversant with M.O.S. and A.R.B. publications.

CONTRIBUTORY Staff Pension and Life Assurance Scheme.

APPLICATIONS, giving full details of qualifications, experience, age and salary required, and quoting Ref. 31/6, should be forwarded to:

The Personnel Manager,
Hunting Percival Aircraft, Limited,
The Airport,
Luton,
Beds. [7028

Westland Aircraft Ltd., Yeovil,

require several

SENIOR AIRCRAFT DRAUGHTSMEN

and

STRESSMEN

for work on helicopters.

A GENEROUS non-contributory pension scheme is in operation, and the offices are situated in a delightful country area, within easy reach of the sea. Applications, stating age, experience, and salary required, are to be addressed to the Personnel Manager, Westland Aircraft, Ltd., Yeovil, Somerset. [6988

BRITISH OVERSEAS AIRWAYS CORPORATION
ASSOCIATED COMPANIES

offer

LICENSED A/C engineers' posts with Iraqi Airways (Baghdad). Preferably "A" or "C" Viscount or Viking.

CONSIDERATION given suitable experienced licensed applicants other heavy A/C.

SUCCESSFUL candidates obtain Viscount experience on job possibly followed by Viscount courses Company expense.

APPLY to Staff Manager, Associated Companies, B.O.A.C., Stratton House, Stratton Street, Piccadilly, London, W.1, full details giving qualifications and experience. [7064

WANTED

Executive Pilot

D. H. DOVE

MINIMUM qualifications 3,000 hours twin command, senior commercial and I.R. 1,000 hours on Dove or Heron. Based in Stuttgart, Western Germany. Good pay and allowances, contract employment. Full details in first instance to T. D. Keegan, Ltd., Southend Airport, Southend-on-Sea, Essex. [7050

PILOTS. Those who believe their future lies in flying commercially operated Helicopters should apply, stating age and flying experience, to Box No. 1658. [0998

DO you hold "A" and "C" Aircraft Engineers' Licences? Are you keen to take a pride in your work? Are you tired of being a number, seeking some measure of independence? Are you prepared to work hard and long to keep a small fleet flying at high pressure? If so, Derby Aviation, Ltd., at Elstree Aerodrome, Herts, will be very pleased to hear from you. [7052

HANDLEY PAGE (READING), LTD., The Aerodrome, Woodley, Reading, have vacancies for Senior and Intermediate Draughtmen for interesting work on Civil Aircraft. High commencing salaries are offered and a generous Life Assurance and Superannuation Scheme is in operation. Please send full particulars of experience, etc., to the Personnel Officer. [0284

H. M. HOBSON
LTD.

require additional Staff for

ADVANCED PROJECTS

dealing with

FUEL SYSTEMS
for Gas Turbines, Ramjets and Rocket Motors.

FLYING CONTROLS
for Aircraft and Guided Missiles.

NUCLEAR REACTOR CONTROLS
and other Ancillary equipment.

Vacancies exist in all grades including

DEVELOPMENT ENGINEERS

DESIGNERS

PERFORMANCE ENGINEERS

MATHEMATICIANS

DETAIL DRAUGHTSMEN

TECHNICIANS

★

Applicants for Senior posts should possess an Engineering Degree or similar qualification and have had some industrial experience.

These posts in an expanding organisation carry attractive initial salaries, whilst Welfare facilities are excellent. There is a Non-Contributory Retirement Benefit Scheme.

★

Those interested should write giving full details of age, education and experience to:—

H. M. HOBSON, LTD.,
FORDHOUSES,
WOLVERHAMPTON,
STAFFS.

SITUATIONS VACANT

A, B, AND C Licensed Engineer required for work on light aircraft, salary £18 per week; if holding a D licence, £20 a week. Immediate vacancy. Apply Box No. 1392. [7012

RADIO Mechanics (male or female) wanted immediately. Workshop or aircraft experience essential. Pay according to ability. Apply: Chief Radio Engineer, Dan-Air Engineering, Ltd., Lasham Airfield, nr. Alton, Hants. [7070

WANTED. Unlicensed engineers. Must have experience on maintenance of light aircraft engines and airframes. Apply: Manager, Southend-on-Sea Municipal Flying School. Tel.: Rochford 56204. [7059

REPRESENTATIVE/Salesman required having good contacts with manufacturers/operators/embassies to sell surplus origin instruments, ancillaries, ground equipment, and aircraft spares. Box No. 1551. [7042

ELECTRONICS Research Manager required to lead a team of physicists and engineers working on a wide range of development projects. High salary and opportunity for well qualified engineer or physicist for this important post. Laboratory within easy reach of London. Applications in writing giving full details of past experience in strictest confidence to Managing Director, Box No. 1688. [7056

DESIGN Draughtsman required by light mechanical and hydraulic engineers in Berkshire. Minimum qualifications should include O.N.C. and apprenticeship or other practical training. The position offers a good salary, pension fund and pleasant working conditions. Applications, which will be treated in confidence, should be addressed to Ref. FKM, British Ermeto Corporation, Ltd., Hargrave Road, Maidenhead, Berks. [7063

AN Engineer is required for a responsible position on the Head Office Staff of a well-known firm specialising in the manufacture of high-pressure valves and couplings. Preferred age range is 24-30. Applicants with commercial or administrative experience and interests are invited to submit brief details of their general education, technical training and experience to Ref. FKM, British Ermeto Corporation, Ltd., Hargrave Road, Maidenhead, Berks. [7061

KELVIN & HUGHES, LTD. (Basingstoke), have a vacancy in their Research Investigation and Test Equipment Section for an Engineer with Higher National Certificate or equivalent qualification, preferably with some experience of aircraft instruments or small mechanisms, for investigation of production difficulties and similar work; also vacancies occur for two Engineers of Ordinary National Certificate standard, preferably with some electric or electronic experience for general work on investigation and test equipment. These positions offer excellent prospects, experience and ability, but are based on generous scales; adequate payment during illness and contributory pension scheme, etc., are in operation. Canteen, medical services and sports and social facilities are also provided. Applications should be made in writing giving full details of qualifications, age, experience, etc., and addressed to the Personnel Manager, "Kelvin Works," Winchester Road, Basingstoke, Hants. [7038

SITUATIONS VACANT

WORKS MANAGER required for Home Counties engineering factory. Must have had previous mass production experience of engineering components and assembly. Excellent opportunity for top qualified man. Salary commencing at £2,000 according to qualifications and past experience. Write in strictest confidence to Managing Director. Box No. 1663. [7071

HANDLEY PAGE (READING), LTD., The Aerodrome, Woodley, Reading, have vacancies for Senior Stress Engineers, with wide practical experience, for interesting work on Civil Aircraft, High commencing salaries with new houses to rent will be offered to those appointed. Life Assurance and Superannuation Scheme in operation. Please send full particulars of experience, etc., to the Personnel Officer. [0285

DESIGN Draughtsmen, all grades, preferably with aircraft structural experience, required for Weapons Research Design Office. Work comprises weapon airframes and test structures, etc. All applications will be treated confidentially and interviews can be arranged to suit applicants. Excellent working conditions in new Design Office near Harrow-on-the-Hill underground station. Apply: Administrative Manager, Messrs. A. V. Roe and Co., Ltd., 2 College Road, Harrow, Middx. Tel.: Harrow 8431. [7039

MARSHALL

AIRPORT WORKS CAMBRIDGE

DESIGN & DRAWING OFFICE

PUBLICATIONS SECTION

RADIO
RADAR MECHANIC

With theoretical knowledge and ability to write reports.

Progressive Position.

Apply in first instance to
PERSONNEL MANAGER

SITUATIONS VACANT

VISCOUNT "A" and "C" licensed Engineer for senior technical position in charge of Viscount maintenance at Manchester Airport. "A" and "C" licence on Viking also an advantage.

MAINTENANCE Schedules Engineer. Preferably with Viscount and Viking experience to work with Chief Inspector, Blackbushe Airport.

APPLY in confidence to Managing Director, Eagle Aircraft Services, Ltd., Blackbushe Airport, Camberley, Surrey. Yateley 2371. [7057

YOUNG Technical Executive required for interesting and responsible position on the commercial staff of hydraulic and light mechanical engineering firm in Berkshire. Candidates must have received a sound general education followed by technical training to Degree or H.N.C. standard. Subsequent industrial experience will be considered in assessing remuneration of successful applicant, which will be on a generous scale. Please write giving brief details of qualifications in first instance to Ref. FKM, British Ermeto Corporation, Ltd., Hargrave Road, Maidenhead, Berks. [7062

B.E.A. REQUIRE a Technical Author and an Assistant Technical Author mainly to prepare amendments to existing publications. Previous experience in this type of work and a background knowledge of aircraft, aircraft systems and accessories is essential. Experience of gas-turbine overhaul would be an advantage. Education should be to at least G.C.E. "O" level in English and mathematics. Salary scales: Assistant Technical Author £807 10s. to £857 10s. per annum; Technical Author £832 10s. to £970 per annum. Prospects of promotion exist for good men. Apply in writing to Senior Personnel Officer, Engineering, British European Airways, Engineering Base, London Airport, Hounslow, Middlesex. [7060

HONG KONG AIRCRAFT ENGINEERING CO. have vacancies for two Maintenance Engineers. Essential qualifications include adequate training, five years experience minimum and possession of an "A" and "C" category licence on modern pressurized aircraft. Preference will be given to applicants holding licences on Constellation 1049 or 749, Viscount or DC6 aircraft. Monthly salary £106 at commencement, plus £36 marriage allowance. Sickness and provident fund operated, accommodation and essential furniture provided. Three year contract initially but position permanent. Apply giving full details precise training and experience, including positions previously held, to Matheson & Co., Limited, 3 Lombard Street, London, E.C.3. Final interview London. [7029

SITUATIONS WANTED

P.P.L. holder seeks post with a view to acquiring sufficient hours for C.P.L. Box No. 1589. [7053

PILOT, C.P.L./R.A.F. white card rating, 620 hours (250 hours this year), aged 27, seeks permanent Position. Apply Box No. 1660. [7067

PILOT. P.P.L. instructor's rating, 3,000 hours singles, twins, heavies. Anything considered. Box No. 1666. [7074

INDEX TO ADVERTISERS

	Page
Abbey Panel and Sheet Metal Co., Ltd.	17
Airwork, Ltd.	10
Alvis, Ltd.	Facing Edit. Page 442
Attewell and Sons, Ltd., B.	64
Auster Aircraft, Ltd.	69
Aviation Developments, Ltd.	16
Avo, Ltd.	63
B.B. Chemical Co., Ltd.	56
Blackburn and General Aircraft, Ltd.	41, 54
Box No. A.C. 32735	64
B.P. Aviation Service	51
Bristol Aero-Engines, Ltd.	Cover iv
British European Airways	71
British Institute of Engineering Technology	66
British Monorail, Ltd.	19
British Thomson-Houston Co., Ltd., The	60
Brooklands Aviation, Ltd.	69
Burnley Aircraft Products, Ltd.	22
Canadair, Ltd.	Between Edit. Pages 436/7
Canadian Steel Improvement, Ltd.	6
Carter and Co., Ltd., B. and F.	58
Clayton-Wright, Ltd., Howard	62
Cornercroft, Ltd.	4
Cross Manufacturing Co. (1938), Ltd.	66, 68
Decca Navigator Co., Ltd., The	28
De Havilland Aircraft Co., Ltd., The	68
	Facing Edit. Page 441
Delaney Gallay, Ltd.	52
Derby Aviation, Ltd.	66
Desoutter Brothers, Ltd.	40
Douglas Aircraft Co., Inc.	5
Dunlop Rubber Co., Ltd.	27
Ekco Electronics, Ltd.	50
Electro-Hydraulics, Ltd.	Between Edit. Pages 436/7
English Electric Co., Ltd., The	70
E.R.S., Ltd.	65
Esso Petroleum Co. Ltd.	Facing Edit. Page 436
Fairey Aviation Co., Ltd., The	68, Facing Edit. Page 440
Fibreglass, Ltd.	9
Field Aircraft Services, Ltd.	67
Fishers	68
Ford (Aircraft Components), Ltd., Frank	18
G.Q. Parachute Co., Ltd.	23
Graseby Instruments, Ltd.	2
Graviner Manufacturing Co., Ltd.	Between Edit. Pages 456/7
Goodyear Tyre and Rubber Co. (Great Britain), Ltd.	55
Habershon and Sons, Ltd., J. J.	61
Hawker Aircraft, Ltd.	Cover i
Hellermann, Ltd.	Facing Edit. Page 456
Henshall and Sons (Addlestone), Ltd. W.	58
High Duty Alloys, Ltd.	Between Edit. Pages 456/7
Hobson, Ltd., H. M.	71
Hunting Percival Aircraft, Ltd.	Facing Edit. Page 457
Hymatic Engineering Co., Ltd., The	Cover iii
Integral, Ltd.	16
Kidde Co., Ltd., Walter, The	8
Kigass, Ltd.	63
K.L.M. Royal Dutch Airlines	22
Leytonstone Jig and Tool Co., Ltd.	64
London School of Air Navigation	68
Marconi's Wireless Telegraph Co., Ltd.	53
Marshall's Flying School, Ltd.	68, 72
Marston Excelsior, Ltd.	1
Martin-Baker Aircraft, Ltd.	Facing Edit. Page 443
M.L. Aviation Co., Ltd.	18
Mollart Engineering Co., Ltd., The	63
Munro Ltd., R. W.	65
Murad Developments, Ltd.	69
Murex Welding Processes, Ltd.	26
Napier and Son, Ltd., D.	24, 70
Newton Brothers (Derby), Ltd.	60
Normalair, Ltd.	11
North British Plastics, Ltd.	64
Northern Mail Order Co.	69
Oil Feed Engineering Co., Ltd.	3
Opperman, Ltd., S. E.	62
Orenda Engines, Ltd.	Cover ii
Ostermans Aero	66
Park, Ltd., R. and J.	58
Parman Aircraft Supplies, Ltd.	67
Peto and Radford	42
Powis and Son, Ltd. David	64
Rapp Group of Companies, The	14
Redifon, Ltd.	44
Redwing, Ltd.	60
Regent Oil Co., Ltd.	21
Rellumit (London), Ltd.	15
Rists Wires and Cables, Ltd.	14
Robinson and Co. (Gillingham), Ltd., L.	7
Roe and Co., Ltd., A. V.	43
Rotol, Ltd.	25
Rumbold and Co., Ltd., L. A.	12
Samlesbury Engineering, Ltd.	61
Sangamo Weston, Ltd.	56
Scottish Aviation, Ltd.	Facing Edit. Page 444
Shell-Mex and B.P. Ltd.	Facing Edit. Page 445
Simmonds Aerocessories, Ltd.	13
Sperry Gyroscope Co., Ltd.	57
Spurling Motor Bodies, Ltd.	65
Stream-Line Filters, Ltd.	20
Teddington Aircraft Controls, Ltd.	12
Thorn Electrical Industries, Ltd.	59
Vickers-Armstrongs (Aircraft), Ltd.	49, 70, 71
Vinten, Ltd., W.	Facing Edit. Page 437
Vokes, Ltd.	62
Westland Aircraft, Ltd.	39
Wilson and Sons (London) Ltd., W.	20

Printed in Great Britain for the Publishers, ILIFFE & SONS LTD., Dorset House, Stamford Street, London, S.E.1, by SUN PRINTERS LTD., London, and Watford, Herts. *Flight* can be obtained abroad from the following: AUSTRALIA AND NEW ZEALAND: Gordon & Gotch, Ltd. INDIA: A. H. Wheeler & Co. CANADA: The Wm. Dawson Subscription Service, Ltd., Gordon & Gotch, Ltd. SOUTH AFRICA: Central News Agency, Ltd; Wm. Dawson & Sons (S.A.), Ltd. UNITED STATES: Eastern News Co., 306 West 11th Street, New York 14

HYMATIC DEVELOPMENTS IN AIRCRAFT EQUIPMENT

Fuel transfer and tank pressurisation

Hymatic Hot Air Reducing Valve PS 48 precisely controls air tapped from the engine at pressures up to 175 p.s.i. and temperatures up to 300°C. Reduced pressure can be selected between 2.5 and 35 p.s.i. It weighs only 1.37 lb. and passes over 100 cu. ft. per minute. The PS 48 valve series has 1″ B.S.P. connections, is $7\frac{5}{8}$″ long and $1\frac{7}{8}$″ dia.

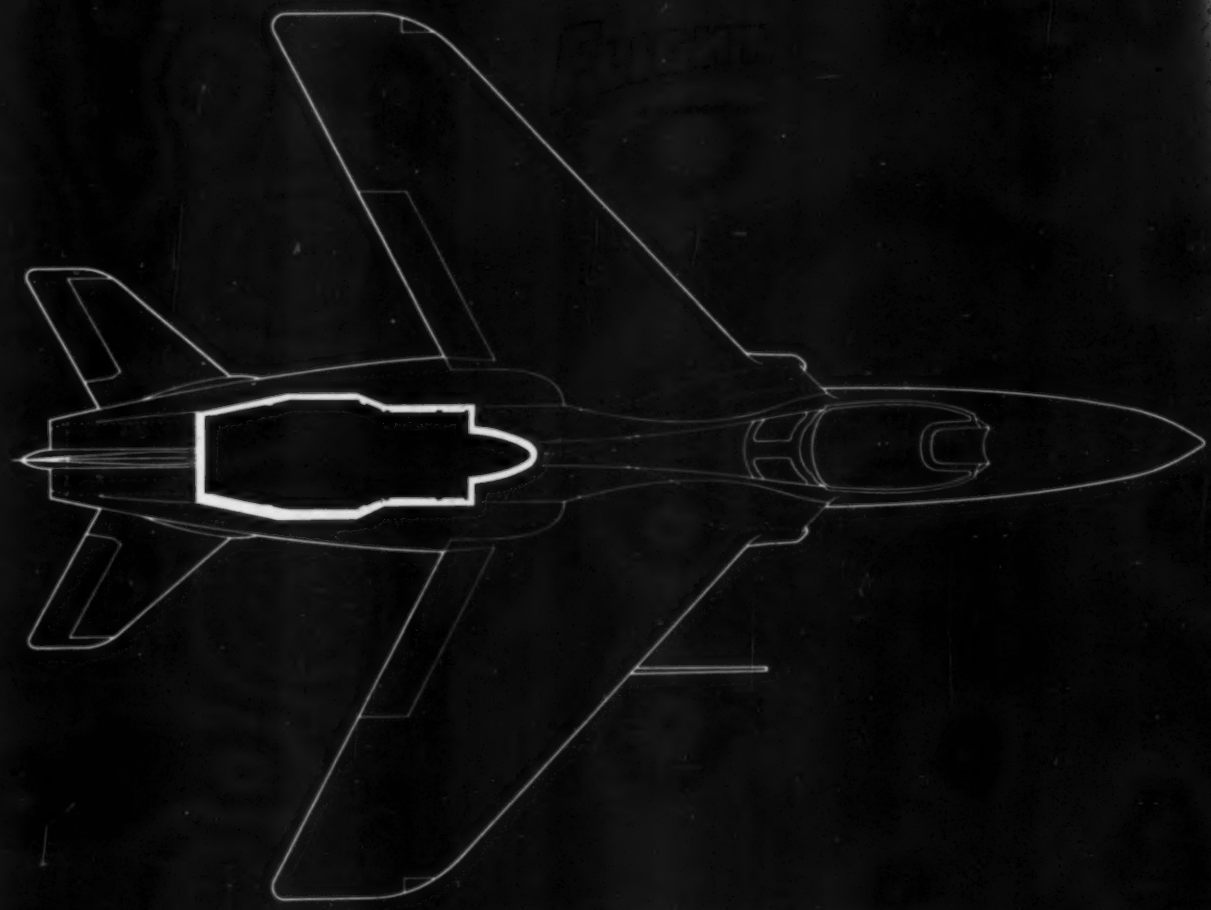
Other products, the design and precision manufacture of which have established Hymatic as leading engineers in the aircraft equipment field, include

High pressure air compressors
Snap jacks and air bottles
High pressure reducing valves
Cartridge operated valves
Fuel system vent and relief valves
Electro-magnetic valves
Anti-G valves
Hydraulic reducing valves

Hymatic

186

THE HYMATIC ENGINEERING COMPANY LIMITED · REDDITCH · WORCESTERSHIRE



THE POWER PLANT IS THE HEART OF A SUCCESSFUL AIRCRAFT

The heart of the Gnat is the Bristol Orpheus

In the early stages of the Gnat light fighter project, Folland Aircraft Ltd discussed with Bristol the design of a suitable lightweight turbojet engine. From the time that the specification of the engine was settled and detail design and development got under way, progress with the Orpheus was phenomenally rapid.

Objectives of the Bristol Orpheus project To produce a simple, lightweight turbojet engine of exceptional power/weight ratio suitable for the new generation of lightweight fighters and also for trainers, transports and executive aircraft. The engine had to be low in cost and easy to manufacture and maintain.

Development progress A year after detail design began, the first Orpheus engine was running. Six months later, an official 150 hours type test had been completed and the engine cleared for flight. On the 18th July 1955 the first Gnat took the air.

This unprecedented speed of development was largely due to the thinking on lightweight turbojets which already existed when the Orpheus project was initiated, combined with the enormous fund of experience amassed at Bristol on turbine engine design.

Current position The Bristol Orpheus B Or 2 last year completed a declared type test at a static thrust of 4,520 lb. Now the Orpheus B Or 3 has been type tested at 4,850 lb for a weight of 810 lb, giving a thrust/weight ratio of 6:1, higher than that of any other type-tested engine. Still more powerful versions are under development, including the recently announced B Or 12 of 6,810 lb thrust.

The Orpheus powers the Folland Gnat, the Fiat G 91 and the Dassault Etendard VI which have all flown; it is specified for the French Breguet 1001 Taon which will fly shortly; also for the Italian Aerfer Leone, the Japanese Fuji TIF 1 trainer, the Spanish Hispano HA 300 lightweight interceptor, and a number of other new aircraft.

Simple to make, operate and maintain; astonishingly light in relation to its power; with scope for reheat and reverse thrust, the Orpheus is a typical example of the creative thinking and care that goes into the design of all Bristol engines.

BRISTOL

Aero-Engines